ROADS and STR[illegible]

HIGHWAYS • BRIDGES • AIR FIELDS • HEAVY CONSTRUCTION

Gillette Publishing Co., 22 West Maple St.
Chicago 10, Illinois

JUNE 1955

TOUGH JOB OF UNDERPINNING

Soils Boring Methods — VI

Contents on Page 4

Acceptance Authorized Under Sec. 34.64 P. L. & R.

P&H Model 655-B; 1½-yd. capacity. P&H builds the world's most complete line of Power Cranes and Shovels.

P&H . . . 20 YEARS AHEAD with welded construction!

Think of it! . . . 20 years ago P&H threw out the old patterns to give you a new and better kind of power shovel — *completely welded of rolled alloy steels!*

Twenty successful years in the field have proved beyond all doubt the advantages you gain through greater strength and the elimination of dead weight. Today's P&H machines give you faster cycles, still more dependable service — still lower yardage costs. Behind today's machines is P&H's long experience in welded design and construction — still 20 years ahead of the field.

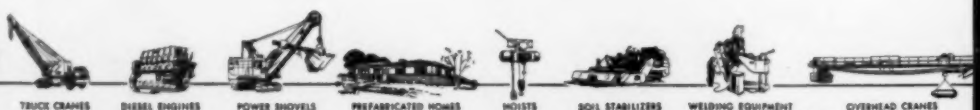
All-welded construction is only one of many major improvements originated by P&H. There are others that will earn you more money than is possible with older style machines you may now be using. Get the facts from your nearest P&H dealer. P&H Power Crane and Shovel Division, Harnischfeger Corporation, Milwaukee 46, Wis.

HARNISCHFEGER

See your **P&H** *dealer*

"Your P&H Dealer has the experience, the organization and the facilities to serve you reliably in every way. He's ready to deliver the kind of on-the-ground service that keeps your jobs moving on schedule. Your P&H Dealer is tops in the business. Get to know him."

the **P&H** *Line*



TRUCK CRANES · DIESEL ENGINES · POWER SHOVELS · PREFABRICATED HOMES · HOISTS · SOIL STABILIZERS · WELDING EQUIPMENT · OVERHEAD CRANES

. . . for more details circle 197, page 16

This 72-in. shop-strutted Beth-Cu-Loy culvert was recently installed for the city of Vancouver, Wash. *Fabricator:* Beall Pipe and Tank Corporation, Portland, Ore.

What other culvert material matches these **BETH-CU-LOY** *advantages?*

For culverts and other sub-drainage requirements, road builders have long recognized the value of copper-bearing, galvanized steel pipe. Beth-Cu-Loy culvert stock is copper-bearing sheet steel. It easily meets the rigid standards of the AASHO, and offers a combination of advantages hard to beat.

Drainage pipe made of Beth-Cu-Loy is strong, yet light enough to be handled easily in long lengths. It is durable enough to withstand the impact and vibration of modern traffic. Flexible enough to simplify alignment and grade maintenance. It stands up under the action of freezing and shifting soils, and reduces root hazard. The copper content gives proven corrosion-resistance to the basic steel, which is further protected by its 2-oz coating (triple spot test).

Bethlehem does not fabricate culvert pipe, but does produce Beth-Cu-Loy galvanized steel stock, in gages 8 through 16, for those who do fabricate it. For names of fabricators in your area, just drop a line to the nearest Bethlehem office.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

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ROADS AND STREETS

Sixty-Three Years of Editorial Leadership

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JUNE, 1955 • VOL. 98 • NO. 6

IN THE NEWS

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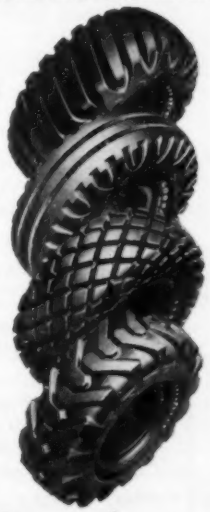
ARTICLES

BITUMINOUS ROADS AND STREETS

EQUIPMENT

SERVICE TRUCKS, right on the firing line, provide on-spot airing and tire inspection.

Our Nation's Newest Super-Road — the West Virginia Turnpike — cuts, fills, bridges, dams and tunnels its way through worse mountain terrain than most contractors have ever tackled. The 88 miles from Charleston to Princeton are 60% solid sandstone and the rest is "largely landslides!" Even Hercules would doff his helmet to the men and machines that wrapped this one up in record time!



And Remember

NOTHING ELSE TAKES IT LIKE 3-T NYLON

. . . for more details circle 194, page 16

No Tougher Test for men or equipment. No surer place to prove the rugged endurance, the superior working qualities of Goodyear off-road and earth-mover tires.

And Today's 3-T Cord Tires are by far the most enduring that Goodyear has ever produced! Goodyear's new and exclusive 3-T process keeps Nylon or Rayon cord at its most bruise-resistant, heat-resistant point, controls tire growth, reduces cracking, tread and body failures to new LOWS. Combined with the toughest tread-stocks yet developed, 3-T Cord is one more big reason why you'll find that Goodyear is there—*all* there—on the toughest jobs you'll ever tackle! Goodyear, Truck Tire Dept., Akron 16, Ohio.

FOR EACH JOB, THERE'S A COST-CUTTING GOODYEAR TIRE!

GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

Sure-Grip, All-Weather—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

ROADS AND STREETS

Devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations; the construction and maintenance of airports. Represents 63 years of continuous publishing in the highway field; combined with Engineering & Contracting and Good Roads Magazines, established in 1892.

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ROADS AND STREETS Acceptance under Section 34.64 P.L. & R., Cedar Rapids, Iowa. Published Monthly. Subscription Price $5.00 per year.

When figuring earthmoving costs...

THE No. 12 GOES ON THE CREDIT SIDE

The Caterpillar No. 12 Motor Grader is a big, versatile machine that always is entered on the credit side of ledger books. Particularly when you figure earthmoving costs.

Knutson-Gould Construction Co. of Kansas City, Mo., knew that when it began hauling fill for the approach to the Missouri Bridge at Jefferson City. Here, you see its CAT* No. 12 Motor Grader as the cost-cutting member of a team of equipment moving 260,000 yards of loess and clay.

The No. 12 is maintaining the haul road. By so doing, it is wringing the last cent of economy out of the big tractor-scraper teams. They can haul their maximum capacity at the highest possible speed. The D7 and D8 pusher Tractors are not called away from the borrow pit to help rescue mired-down equipment.

. . . for more details circle 170, page 16

And down time costs are slashed because the road is an *aid* to the tractor-scrapers, not a torture trail that causes breakdowns.

Your Caterpillar Dealer will be glad to show you the No. 12, No. 112 and the No. 212 Motor Graders at work on your job. Have him demonstrate the reasons successful contractors always put Cat Motor Graders on the credit side when they figure earthmoving costs.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

99% OF ALL CAT MOTOR GRADERS EVER BUILT ARE STILL IN USE

BY KEEPING hydraulic systems free from sludge, rust and foam, you eliminate a major cause of unscheduled stoppages, keep your machines on the job. You can do this by using *Texaco Regal Oil R&O* as your hydraulic medium.

Tests prove that *Texaco Regal Oil R&O has more than ten times the oxidation resistance* of ordinary turbine-quality oils. Users report it has an exceptionally long service life, even under severe conditions, and does a remarkable job of preventing sludge, rust and foam.

Texaco Regal Oil R&O thus assures clean, trouble-free operation, longer life for pumps and other parts, lower maintenance costs. There is a complete line of *Texaco Regal Oils R&O* to meet the requirements of all types and sizes of hydraulic equipment, all operating conditions.

In air compressors, too, *Texaco Regal Oil R&O* assures clean, efficient, low cost performance. It keeps compressors and systems free from harmful deposits and rust . . . lines clear, piston rings free, valves clean.

Texaco Regal Oil R&O is one of the six fine products in the Texaco Simplified Lubrication Plan—all you need to handle all your major lubrication. Let a Texaco Lubrication Engineer give you full information. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Lubricants and Fuels

FOR ALL CONTRACTORS' EQUIPMENT

. . . for more details circle 236, page 16

Are You Moving With the Trend to Better Road Base Courses?

More and More States Are Using Soil-Cement Stabilization to Meet Today's Heavy Traffic Demands!

. . . because it provides the guts to take constant daily pounding

More vehicles, heavier loads, higher speeds coupled with moisture, erosion and slab pumping action take heavy toll from the best highways of yesteryear. But the problem is being met face on in more and more states, counties and townships with soil-cement base stabilization. Soil-cement provides the guts *beneath the surface* that *assures stability on the surface!*

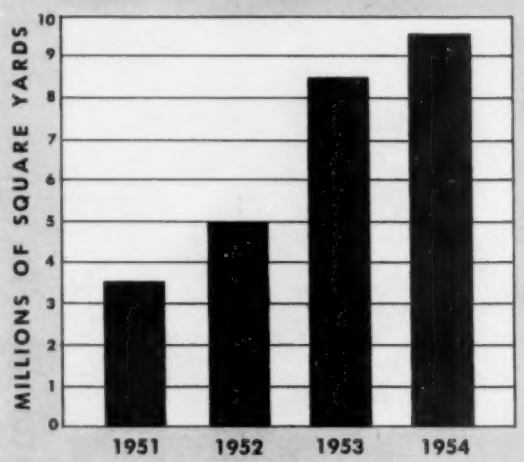
. . . because it virtually eliminates future maintenance costs

To start with, a better, stronger, moisture-resistant soil-cement stabilized base virtually does away with normally expected maintenance work. The economies stretch on for years. We'll gladly send case histories on this point.

. . . because it permits using low-cost materials native to the area

Important original cost-savings are many times evident, too, because native materials can be used. One state saved $30,000, another $20,000, by using sub-standard local free materials stabilized with cement. The facts are worth studying. May we send them?

LOOK AT THE GROWTH OF SOIL-CEMENT STABILIZATION FOR BASE COURSES IN ONE STATE



Most Soil Cement Is Mixed With Pettibone Wood Mixers!

The Model 54 Pettibone Wood Single-pass Road-mixer, illustrated at the left, mixes up to 350 tons per hour on an 8′ windrow. This big mixer is tractor drawn and powered. Also available is Model 42, single pass, self propelled. Both feature Pettibone Wood's exclusive mixing action by the originator of mix-in-place road building equipment.

PETTIBONE WOOD
MFG. CO.

Subsidiary of PETTIBONE MULLIKEN CORP., Chicago
6900 Tujunga Avenue
North Hollywood, California
Telephone: STanley 7-3281

. . . for more details circle 224, page 16

How Link-Belt Speeder engineering helps both the shovel-crane and the operator

increase earning capacity!

LS-98 with 60′ boom and 1¼ yard bucket works in sand and gravel pit.

You're ahead on every job —Link-Belt Speeders—whether crawler or rubber-tired—are years ahead of the shovel-crane industry. Only Link-Belt Speeder offers you Speed-o-Matic—the true power hydraulic fingertip control system. Only Link-Belt Speeder offers you so many outstanding design, construction and operator advantages. For facts on every machine in the ½ to 3-yd, 10 to 60-ton work range—contact your Link-Belt Speeder distributor or write Link-Belt Speeder Corporation, Cedar Rapids, Iowa.

13.548

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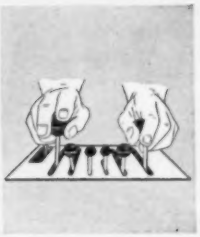
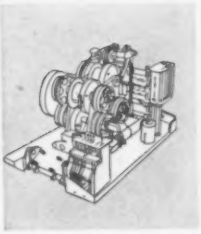
Two-way speed increase



● Speed-o-Matic, the true power hydraulic control, provides fast, easy, smooth response . . . ideal control *for speed with accuracy*. It's also engineered to *reduce operator fatigue* — enables him to maintain greater output with less effort.

Extra power, stamina



● Anti-friction bearings, splined shafts and precision-machined surfaces at every important point convert more *rated* hp into actual line pull. All-welded, stress-relieved construction permits use of extra power.

More work-time

● Speed-o-Matic reduces operator fatigue, losses due to end-of-the-shift letdown. Further, it minimizes downtime. For example, Speed-o-Matic clutch is hydraulic actuated, self-compensating. Eliminates frequent stops for adjustment.

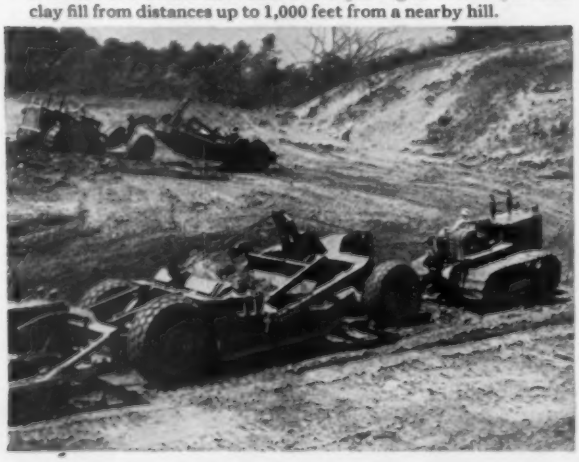
A demonstration can be arranged to suit your convenience. See one of these great machines in action and judge for yourself why they are today's most advanced shovel-cranes.

LINK-BELT SPEEDER

Builders of a complete line of crawler and rubber-tired shovel-cranes

DAM FOR CORDRY LAKE, 700 feet thick at the base, is built by this fleet of three INTERNATIONAL TD-18A crawlers and scrapers and one INTERNATIONAL TD-14A with hydraulic dozer used for push-loading on inclines and in soft spots, and some other equipment.

LAKE LEAKAGE is eliminated by removing all porous soil and stone from the site of the dam base and replacing it with impervious clay fill from distances up to 1,000 feet from a nearby hill.



BUILDING UP THE DAM BASE moves along on schedule as one of three TD-18A scraper combinations brings a heaping load of clay to the construction site.

Moves 1,000,000 cubic yards to build a lake

Howard Prince, veteran Indiana contractor, has used INTERNATIONAL crawlers to build more than 100 lakes since 1935—and he has two large lakes under construction right now!

A water shortage is being remedied and a new vacation area opened by a chain of fourteen lakes being built across Brown County, Indiana, by veteran lake builder Howard Prince, head of the Prince Lake Building Company, Nineveh, Indiana.

Latest and largest in the chain is Cordry Lake, the 103rd lake to be built by Prince.

Cordry Lake, which will eventually cover more than 600 acres, is being created by building a dam 750 feet long, 120 feet high, across two small streams. In excavating unsuitable material from the dam site and borrowing leakage-proof clay from a nearby hill, the lake builders will move over 1,000,000 cubic yards of dirt.

The entire job is being handled by Prince's fleet of seven INTERNATIONAL crawlers with matched IH scrapers and blades, and some other equipment.

Howard Prince has been an INTERNATIONAL owner ever since he first started in business, and states: *"I bought my first* INTERNATIONAL *crawler in 1935 and I've been using them ever since.*

"I've been increasing my INTERNATIONAL *equipment until I now have three TD-18As with scrapers, two TD-14As with blades, a TD-9 and two TD-6s on this job.*

"On lake building projects, as well as all other types of work, they have proved both dependable and economical through the years."

Get the same information that has enabled this successful contractor to make such wise equipment buys for 20 years. Call your INTERNATIONAL Industrial Power Distributor today. From the world's most modern line of earthmoving equipment he'll select the machine "right" for your job and demonstrate it on your job any time you say.

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILL.

INTERNATIONAL HARVESTER

INTERNATIONAL INDUSTRIAL POWER

MAKES EVERY LOAD A PAYLOAD

REMEDY FOR NATURE'S OVERSIGHT. The Brown County Lake Development project is adding immeasurably to the natural beauty of that Hoosier county by building 14 lakes in an area that has all the scenic wonders except lakes.

. . . for more details circle 204, page 16

ADC* Oilprint Analysis

CHECKS CRANKCASE OIL IN MINUTES

Shell Research gives you new oil-change yardstick—

Now—operators can test crankcase oil in the short time allotted for refueling and crankcase oil checks. The Shell ADC Oilprint Analysis gives a practical and accurate oil evaluation in minutes.

ADC Oilprint Analysis means big savings when used in your preventive maintenance program . . . gives valuable information on engine and oil conditions. It answers the question "When do I change my oil?" thus eliminating the draining of usable oil and the risk of using oils loaded with contaminants.

See for yourself how the new Shell ADC Oilprint Analysis can save you money in preventive maintenance. Let us show how you can use this new service for your equipment.

SAVES... Time, Money, Engines, Oil

*Trademark

SHELL OIL COMPANY,

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

. . . for more details circle 230, page 16

WHAT'S NEW in Equipment and Materials

Heavy Duty Earth Augers

The addition of Pengo 6 in., 7 in., and 8 in. diameter heavy duty flight auger to its line has been announced by Petersen Engineering Co., Santa Clara, Calif. These heat treated manganese moly alloy cast steel augers are being produced to fill a need for a small diameter yet heavy duty flight auger for use with earth boring machines of the type used by the utility industry.

For more information circle 101 on Service Coupon this page and mail now.

Device for Preventing Insufficient Lubrication

Protection against damage resulting from insufficient lubrication is now available at small added cost on all horizontal shaft models of the heavy-duty industrial air-cooled engine line of Continental Motors Corporation, Detroit 15, Mich. It is provided by an automatic low oil level iginition cutoff, which shorts the engine out when the crankcase oil level drops too low for safe operation.

The device has only one moving part, a small closed cylinder of corrosion-proof metal, which is free to float within a metal guide grounded inside the engine base. When the oil level drops too low for proper lubrication, one end of this float comes to rest on a brass stud connected to a lead from the ignition coil but insulated from the base. Since the other end of the float is in contact with the grounded metal guide surrounding it, the effect is to short-circuit the ignition and stop the engine. Replenishment of the oil, of course, raises the float off the stud, eliminating the short and permitting the engine to be restarted.

For more information circle 102 on Service Coupon this page and mail now.

Heavy-Duty Dump Bodies

A special new series of heavy-duty construction and excavator dump bodies has been announced by Hercules Steel Products Corporation, Galion, Ohio. Designed especially for heavy excavating and hauling jobs, the new Hercules HD Series dump bodies are built especially for shovel loading of rock, rip-rap, shale, gum clay, and to handle other severe loading and hauling operations.

Standard lengths of 12 ft. to 16 ft., with capacities to 15 cu. yd., are available with either telescopic or underbody hoists. Heavy-duty construction includes 8-gauge shells, ¼-in. steel plate corner posts and full I-beam understructure.

For more information circle 103 on Service Coupon this page and mail now.

Device for Reflectorizing Embossed Signs

A new device that makes embossed signs easier to reflectorize with "Scotchlite" brand reflective sheeting has been announced by Minnesota Mining and Manufacturing Co., St. Paul, Minn. It is a new rubber diaphragm for use in heat-vacuum applicators. Made of rough rubber, the new diaphragm allows air trapped by raised letters and borders to escape through evenly spaced, microscopic depressions in the surface of the rubber. Previously, shops reflectorizing embossed signs used seamless muslin or "bleeder" strips to allow the air to escape.

The new diaphragm has become standard equipment on heat-vacuum applicators; replacement diaphragms are available for the 36 in., 4-by-8 ft. and 5-by-12 ft. applicators.

Information on the applicators can be obtained by writing the 3M Company, Dept. G5-02, 900 Fauquirer St., St. Paul, Minn.

For more information circle 104 on Service Coupon this page and mail now.

More equipment news pages 124-130, 148-157

Tarps and Tents For Contractors

A complete line of "Herculite" tarpaulins and coverings of all shapes and sizes, and a complete line of tents has been announced by Fellowcraft Engineering, Inc., 270 Jelliff Ave., Newark 8, N.J. The "Herculite" line is made from a new light-weight material which incorporates the use of nylon and vinyl plastic film. Among the many features claimed for it: is exceptional tear strength, complete and easy to store, water-proof, rot and mildew-proof, with sun-fast colors. This material has met most rigid specifications of the armed services. All seams are electronically welded; not just sewn.

For more information circle 105 on Service Coupon this page and mail now.

Improved Taylor Soil Hydrometer

Equipped with Bouyoucos grams-per-liter scale (copyrighted) to ASTM and AASHO specifications, an improved hydrometer for determining soil particle size has been announced by Taylor Instrument Companies, 95 Ames St., Rochester 1, N.Y. One of its chief refinements is a molded body of streamlined design which reduces the amount of material settling on the shoulders of the instrument, promotes accuracy of readings, and markedly diminishes agitation of the oil suspension. In addition, improved uniformity of size and shape achieves uniformity in volumetric displacement, while a two-sided scale increases reading convenience. All changes are reflected in greater precision.

For more information circle 106 on Service Coupon this page and mail now.

For more items . . . see page 124

MAIL THIS COUPON TODAY!

ROADS & STREETS
22 West Maple Street
Chicago 10, Illinois

CIRCLE THE NUMBERS AND MAIL NOW!

Please send me further information on products and materials mentioned in the June Roads & Streets as circled below

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NOT GOOD AFTER JULY 15, 1955

A READER SERVICE FOR YOUR NEEDS

INSTANT POWER

for dependable ignition

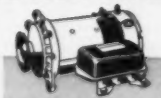
AMERICAN BOSCH MAGNETOS

Better to start with — best in the long run. That's the power-packed story of American Bosch Magnetos . . . today's finest ignition units. Many advanced features give them greater power for split-second starting and premium engine performance PLUS built-in stamina that assures years of constant, trouble-free service in construction equipment. That's why they're so widely used as original equipment by many leading engine builders.

For your every replacement need — from the largest, heavy duty engines with either high or low tension ignition, down to today's compact, high-speed power units — there's an American Bosch Magneto precisely engineered for maximum efficiency at all operating speeds and loads. Moreover, American Bosch gives you all the advantages of one of the world's largest and most efficient Magneto Service organizations through your nearby AB Service Agency. Write today for application data on your high or low tension ignition engines. American Bosch, Springfield 7, Mass. A Division of American Bosch Arma Corporation.

AMERICAN BOSCH

Automotive and Aviation Magnetos



Generators and Regulators

Components for Aircraft Engines

Small Electric Motors

Electric Windshield Wipers

Diesel Fuel Injection Equipment

. . . for more details circle 251, page 16

Uranium Strike!

Back in the hills of the Colorado Plateau, the dependability and low-cost operation of Le Roi Compressors pay off

Uranium is a magic name. And to anyone interested in low-cost, dependable, air compressor operation, the name of Le Roi is magic, too. Just take a look at a few features that keep Le Roi Compressors running after others have "called it quits":

- Suction and discharge valves are interchangeable.
- Cylinders have circumferential fins for better cooling — greater efficiency.
- Radiators and intercoolers have sectional cores.
- Larger air receiver reduces pulsation and cools the air so that tools run better.
- Larger engines for greater reserve power permit slower operating speeds, longer life.

Le Roi Compressors are available in sizes from 85 cfm to 600 cfm. Gas or diesel models and a complete selection of mountings. Bulletins give full details — write for your copy.

C-157

LE ROI *Division of Westinghouse Air Brake Co.*
Milwaukee 14, Wisconsin

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ALABAMA: Birmingham, Mobile—ARIZONA: Phoenix—ARKANSAS: Little Rock—CALIFORNIA: Bakersfield, Long Beach, Los Angeles, San Francisco—COLORADO: Denver, Grand Junction—CONNECTICUT: Hartford—FLORIDA: Jacksonville, Miami, Tampa — GEORGIA: Atlanta, Augusta — IDAHO: Boise, Idaho Falls, Twin Falls—ILLINOIS: Chicago—INDIANA: Indianapolis—IOWA: Cedar Rapids, Des Moines, Waterloo — KANSAS: Great Bend, Kansas City, Pratt, Wichita — KENTUCKY: Lexington, Louisville — LOUISIANA: New Orleans, Shreveport—MAINE: Augusta—MARYLAND: Baltimore, Hyattsville—MASSACHUSETTS: Hyde Park, Newton Highlands, Worcester — MICHIGAN: Detroit, Grand Rapids—MINNESOTA: Duluth, Minneapolis—MISSISSIPPI: Jackson—MISSOURI: Joplin, St. Louis—MONTANA: Billings, Great Falls, Kalispell, Missoula—NEBRASKA: Omaha—NEW HAMPSHIRE: Manchester—NEW JERSEY: Cranford, Kingston—NEW MEXICO: Albuquerque—NEW YORK: Albany, Binghamton, Buffalo, Long Island City, Newburgh, Rochester, Saugerties, Syracuse, Whitesboro, Woodside (L.I.)—NORTH CAROLINA: Charlotte—OHIO: Cincinnati, Cleveland, Columbus, Dayton, Toledo—OKLAHOMA: Oklahoma City, Tulsa—OREGON: Portland—PENNSYLVANIA: Bethlehem, Harrisburg, Philadelphia, Pittsburgh—RHODE ISLAND: Providence—SOUTH CAROLINA: Columbia—SOUTH DAKOTA: Rapid City, Sioux Falls—TENNESSEE: Chattanooga, Knoxville, Memphis, Nashville—TEXAS: Dallas, El Paso, Houston, Lubbock, San Antonio—UTAH: Salt Lake City—VIRGINIA: Richmond, Roanoke—WASHINGTON: Seattle, Spokane—WEST VIRGINIA: Clarksburg, South Charleston—WISCONSIN: Milwaukee — WYOMING: Casper.

. . . for more details circle 211, page 16

ROADS AND STREETS
Sixty-Three Years of Editorial Leadership

Washington News Letter

By Duane L. Cronk

June 8, 1955

Overwhelmed by a vote of 60 to 31, President Eisenhower's "grand plan" for 10 years of accelerated highway construction took a fatal nose-dive in the U.S. Senate last month. Every Democratic senator but one turned "thumbs down" on the most ambitious roadbuilding scheme ever envisioned, and 13 Republicans crossed party lines to squelch the Administration's hope of spending $31 billion in federal funds on the nation's highways before 1965.

A substitute measure, written along entirely different lines and sponsored by Senator Albert Gore (D., Tenn.) was adopted, instead, the same day.

* * *

Sorely disappointed highway interests who were plugging for passage of the Eisenhower proposal are turning hopefully to the House where hearings are winding up on the Administration bill. Ike's program has received much better treatment thus far on that side of the capitol. Still, it is generally conceded, nothing remotely resembling the bold recommendations of the Clay Committee will make the tortuous passage through Congress now.

What killed the President's program? Literally dozens of highway and civic organizations representing governors, mayors, state road officials, contractors, farmers, motorists and truckers, and hundreds of individuals had appealed for it. Months of study by the Bureau of Public Roads had supported it and fiscal experts had testified to its soundness. But it didn't make the grade.

* * *

Many blame top-level mismanagement. While the White House dilly-dallied, the Democrats came up with the Gore bill and party lines formed. It became increasingly apparent throughout the lengthy Senate hearings that political considerations would probably dictate the eventual fate of the plan there.

On the Senate floor last month, as in committee, the major criticisms thrown against the "grand plan" were (1) that it would make use of what Senator Byrd (D., Va.) called "an ingenious corporate device" to finance the program outside the debt limitation, (2) that it would concentrate revenues for the next 10 years on the National Interstate System to the neglect of other federal-aid systems, and (3) that it would cost $11 billion in interest charges on the bonds. The charges proved too strong a combination for Ike's supporters to beat.

(continued on next page)

Although neither bold nor imaginative in the degree which highway men believe the road needs of America demand, the Senate bill certainly has merit. It would authorize a 300% increase in federal aid ($12.58 billion over the next five years to be matched by $5.36 billion). Specifically would provide:

- $900 million annually (starting June 30, 1955) for regular federal-aid systems, of which $400 million would go to the primary, $300 million to secondary and $200 million to the urban, all to be matched 50-50.
- $1 billion in 1956 for the Interstate System, accelerating to $2 billion in '60 and 61, to be matched on a 90-10 basis.
- $330 million over the five years for roads in national parks and forests.
- Authority for the federal government to condemn or purchase land for Interstate System projects, cost to be shared by state on the 90-10 basis.
- Increase of the Interstate System from 40,000 miles to 42,000 miles.
- Denial of federal aid for Interstate projects in states which, after July 1, liberalize truck weight and dimension laws to exceed their current regulations or AASHO standards, whichever is greater.
- Authority for use of federal funds to pay up to 50% the cost of relocating utilities on a federal-aid job, the total funds thus used to be limited to 2% of the state's apportionment.

* * *

Contractors and highway officials in some states will be relieved to hear that a section requiring application of Davis-Bacon Act wage and hour laws to Interstate projects was jetisoned after heavy debate on the Senate floor. The provision would have required that prevailing wages in an area become the wage standard on such jobs. The section reportedly was cast out to hold the support of Southern senators.

* * *

Charges of unfair distribution of money to the states were leveled against both the Eisenhower plan and the Gore proposal. Critics of the Administration bill declared it over-favored the Interstate System. Critics of the Gore bill (as passed) called it a "blunderbuss" measure that would scatter funds among the states without regard to need. Senator Case (R., So. Dak.) pointed out that 18 states would get more than they need to complete the Interstate System within their borders and 30 states would get less than enough. It would take New Jersey 40 years to complete while others would complete in five years.

* * *

It's up to the House now . . . and then joint conference between the two chambers. Observers expect a last-ditch fight for the Eisenhower program this month and a step-up in "appeals to the people" by industry advocates of the "grand plan" via radio, television and the press. By the time this is read, a House bill may be under debate as contentious as took place in the Senate.

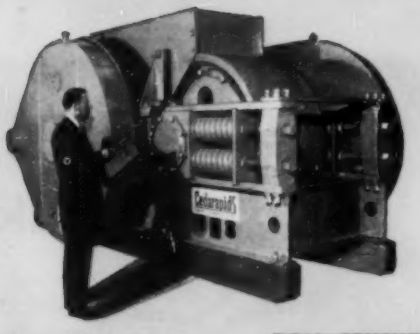
BIG MACHINES

BIG PROFIT

BIG PRODUCTION

Cedarapids

Built by IOWA



ROLL CRUSHERS

This new 55" x 30" Roll Crusher is a *big* producer for secondary crushing operations. Large diameter of the rolls handles exceptionally large feed. With 20% wider roll shells, capacities range up to 520 tons per hour, depending upon conditions.

8 ROLL CRUSHER SIZES MEET EVERY NEED

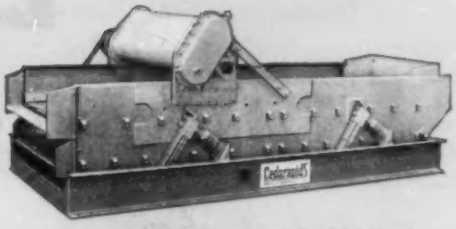
16" x 16"	30" x 18"	30" x 25"	40" x 24"
24" x 16"	30" x 22"	40" x 22"	55" x 30"

DOUBLE IMPELLER IMPACT BREAKERS

This big Breaker reduces rock from 53" x 60" down to 3" minus in one pass and turns out from 500 to 800 tons of ideal cubical shaped aggregate per hour!

AVAILABLE IN 7 SIZES

For portable or stationary plants	For stationary applications
Model 2222	Model 4350 Standard
Model 3042	Model 4350 Heavy-Duty
Model 3645	Model 5360 Standard
	Model 5360 Heavy-Duty



HORIZONTAL VIBRATING SCREENS

The *horizontal* position of the screen cloth openings permit *more* of the correct size material to go through the screen, yielding 20% to 30% more accurate gradation and more yards per hour. A horizontal screen provides as much as 12½% greater screening area than an inclined screen of the same length! You can use a smaller screen, get the same capacities as with a larger inclined screen.

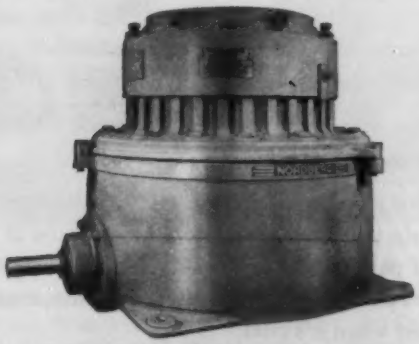
Available in single, double and triple deck models in sizes ranging from 3' x 8' to 48" x 14'.

JAW CRUSHERS

The big 32" x 40" Jaw Crusher is the ideal unit for big primary crushing operations because it's engineered in every detail to give *extra* capacity with smooth, steady performance and low maintenance and operating costs.

AVAILABLE IN 12 SIZES

10" x 16"	15" x 24"	22" x 25"
10" x 20"	15" x 36"	22" x 36"
10" x 24"	18" x 24"	25" x 40"
10" x 36"	18" x 36"	32" x 40"



SYMONS® CONE CRUSHERS

Supplied as individual units or in Cedarapids Secondary Plants and Scalping Units. Nordberg-built Symons Cones give you big-volume, low-cost finished crushing of even the hardest or most abrasive rock or gravel to uniform, finely-crushed aggregate.

SIZES AVAILABLE

22", 2', 3' and 4'

SYMONS—*A registered Nordberg trademark*

IOWA MANUFACTURING COMPANY

CEDAR RAPIDS, IOWA, U.S.A.

For faster job-cycles make it 2-Cycle Power

SPECIFY GENERAL MOTORS DIESEL

in all your construction equipment

MODERN 2-cycle design is the main difference between GM Diesels and most other Diesels built today.

Two-cycle design means power on every piston downstroke. This is one of the reasons why a General Motors 2-cycle Diesel accelerates faster, responds to governor controls quicker, takes sudden shock loads in stride.

That means more work per shift from your equipment—means you can handle bigger contracts with fewer units, keep your capital investment down and your profits up.

But you get more than faster work when you *specify* GM Diesel power.

You get engines that are easy to service and maintain, that help you keep parts stocks low because of the high degree of parts interchangeability. You get engines that start at the push of a button with no auxiliary, even in wet weather and when it's cold.

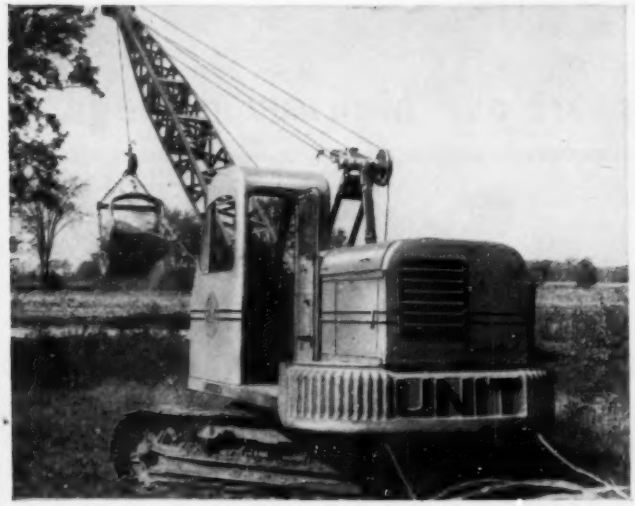
And you get Diesel engines backed by a network of GM Diesel distributors ready to supply fast service and quick delivery of low-cost factory parts where and when you need them.

Today you can specify GM Diesel power in over 750 different models of equipment built by more than 150 manufacturers. Get their names from your local GM Diesel distributor or write direct for the list.

"QUICK SERVICE WHEN I NEED IT"

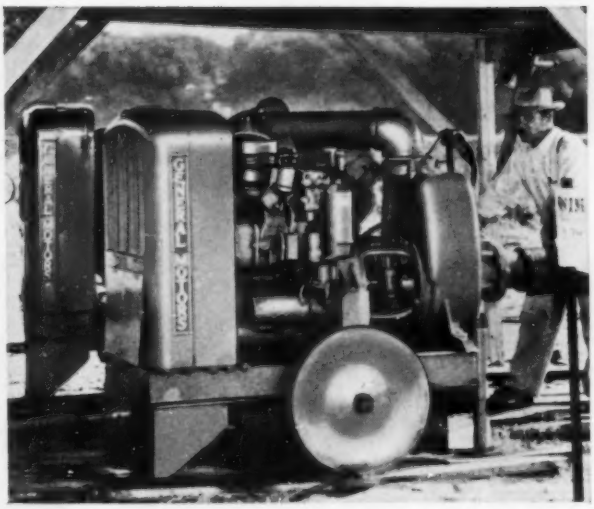
Iowa's Gene McClain Construction Company has GM Diesel power in this Cedarapids asphalt plant and in a shovel. Superintendent Jim Grundy says, "We've standardized on GM Diesel power for this operation because GM Diesels are economical to run. Dealer service is quick and good . . . the company stands behind their product."

GM
GENERAL MOTORS
DIESEL POWER



MOVES 1000 YARDS IN 10 HOURS

And that's big production for a ¾-yard dragline. This GM Diesel-powered Unit has been working for Michigan contractors, Henry Schmid Sons, since 1946. Its General Motors 2-cycle Diesel burns about 12 gallons of 14.9¢ Diesel fuel a day—cost only $100 for repairs in more than 17,000 hours of operation.



MULTIMILLION-DOLLAR DEPENDABILITY

Faced with wet footings on this multimillion-dollar sewage plant contract, Pittsburgh's Rust Engineering Company put GM Diesel-powered Jaeger dewatering pumps to work. Superintendent P. J. Pedone says, "The GM Diesel engines have proved very satisfactory . . . they're keeping footings dry so we can go ahead with the job."

3 GM UNITS ALMOST DOUBLE OUTPUT

Kansas' Reno Construction Company reports their new Cedarapids portable rock crusher with three new GM Diesels stepped up output from 200 tons per hr. to almost 400 tons. One "6-110" Diesel powers the primary 36" x 45" double impeller impact breaker; a GM Twin "6-71" powers the secondary and a "3-71" powers the conveyors, screen and feeders.

25% MORE WORK FROM GM DIESEL POWER

One of the best known excavating companies in Northern New Jersey and New York State is Raymond L. Cole Construction Co. "Our GM Diesel-powered American shovels do at least 25% more work than other Diesels in the same number of hours. They are more flexible," reports this user of one 1½- and three ¾-yard shovels . . . all GM powered.

DETROIT DIESEL ENGINE DIVISION

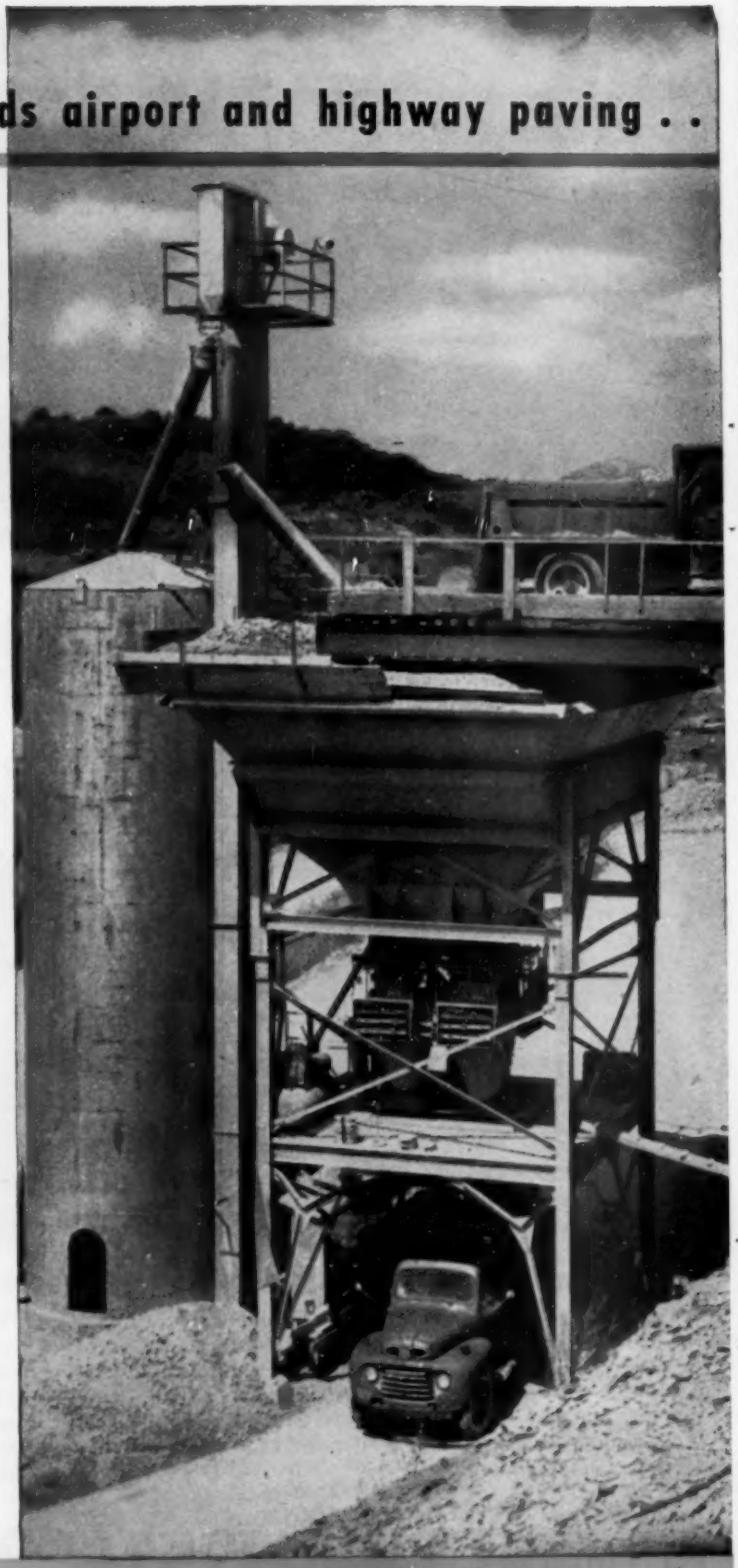
GENERAL MOTORS • DETROIT 28, MICHIGAN

Single Engines . . . 30 to 300 H.P. • Multiple Units . . . Up to 893 H.P.

. . . for more details circle 191, page 16

21-SECOND batch time

speeds airport and highway paving . .



Johnson Automatic Batch Plants, like the one shown here, accurately weigh out aggregates and cement ahead of heaviest paving schedules on highways, airports, and other large-volume concrete jobs. For example:

Keeps two 34-E pavers busy . . . One plant, with one batcher operator, easily supplies enough materials to keep two 34-E pavers busy full time. A 1¼-cu. yd. batch is weighed up, and discharged into truck, in as little as 21 seconds. One-stop charging of batch trucks speeds production. (Plant also can be arranged for two-stop charging.)

Automatic control maintains high plant output all day . . . assures pin-point weighing accuracy of every batch. A separate, fully-automatic weigh-batcher is used for each of the aggregates, and for the cement. All materials weigh up at the same time for greatest speed. These single-material Johnson batchers operate on electro-pneumatic control . . . fill valves and discharge gates are automatic air-ram operated.

Multiple batch selections . . . For road-builder's use, dial scale with electric cut-off switch is usually used. When more than one batch size is required, single material batchers can be equipped with mix selector for 12 different mixes . . . all controlled from central operator's station. (Each of the single-material aggregate batchers can be equipped with a moisture compensating lever which automatically gives a dry weight of material being weighed.) Up to 120 mix selections are available on large Johnson batch plants for dams, and commercial ready-mix installations.

Investigate the possibilities of increasing concrete production on your operations with one of these Johnson Automatic Batch Plants. In many instances this equipment can be added to an existing plant. For complete details, contact your Johnson distributor, or write to us.

C. S. JOHNSON COMPANY

CHAMPAIGN, ILL. • (Koehring Subsidiary)

JOHNSON *automatic* BATCH PLANTS

CJ414

Mack Model LRSW working under a 4-yard shovel on the *tough* Ardsley-Tarrytown section of New York Thruway.

big shovels call for big trucks

Today's big-yardage jobs demand maximum loads per haul and faster time cycles from shovel to dumping point and return. Increasing use of big 4- and 5-yard shovels points to the Mack Model LRSW six-wheel dump truck as the answer to these stepped-up requirements.

Here's a truck that's built to keep big shovels on the go . . . to give contractors increased production per driver and per truck dollar invested.

Rated at 30 tons payload capacity, it will move 25 heaped yards with unfaltering ease over the toughest terrain. No miring in with Model LRSW—it has the advantage of Mack's Balanced Bogie with exclusive Power Divider, enabling it to pull through where other trucks bog down. In actual service Model LRSW has demonstrated its ability to maintain the time schedule of smaller-capacity dumpers.

Why not investigate the big-unit economy of Mack Model LRSW. It will pay you to see these big jobs at work.

MACK TRUCKS Empire State Building, New York 1, N. Y.

. . . for more details circle 219, page 16

HOW TO GET MORE WORK FROM A USED TRACTOR

Hystaway working on Ohio Turnpike Construction

Hystaway® On a Used Tractor Gives You a Low-Cost, Mobile Excavator That Pays Off On Road Construction and Maintenance

Mount a Hystaway on a used (or new) tractor and you get a highly productive, low-cost, excavator-crane that moves at full tractor speeds, and is able to travel unassisted over long stretches of rough terrain.

Culvert, catch basin and footing excavation, ditching, pioneer work, structural crane work are just a few of the many jobs that make Hystaway an investment that pays its own way on road jobs.

Full tractor mobility makes possible fast moves from one part of the job to another. The exclusive Hystaway equalizer beam assembly permits full track oscillation. You work anywhere crawler tractors can go.

Hystaway has more power than any other ½ yard revolving machine. This extra advantage provides ample lugging power to prevent hang-ups, stalling and excessive wear—and is also easier on the operator.

With Hystaway you **dig and bulldoze with one machine.** There is "no tail swing" so you can work in tunnels, close to the slope of fills, close to the roadway without blocking traffic, and from other digging positions that would be extremely difficult for full-revolving machines.

Hystaway is designed for fast mounting, and demounting, on Caterpillar D6, D7 or D8 Tractors.

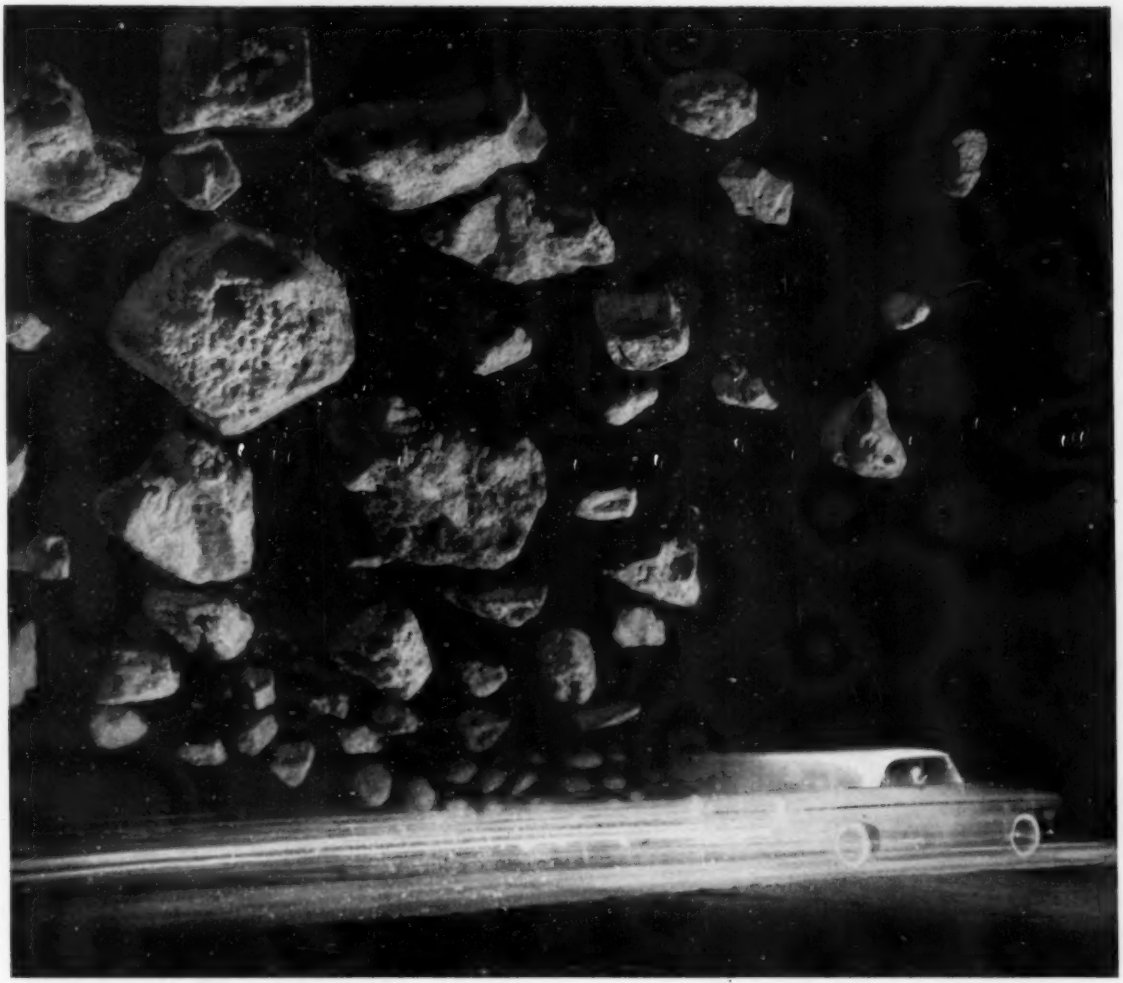
Your Caterpillar-Hyster Dealer will be glad to give complete details, or write for literature to Hyster Company, Tractor Equipment Division, 2995 N. E. Clackamas, Portland, Oregon; 1895 N. Adams St., Peoria 1, Ill.

HYSTER COMPANY

"Matched Design" Tractor Tools for Caterpillar-built Tractors

HYSTER

. . . for more details circle 203, page 16



Keep that Gravel Grounded !

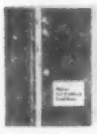
Stabilize your roads with Morton Salt

- **Cut aggregate loss**
- **Save man-hours and maintenance money**
- **Reduce accidents caused by loose gravel**

Gravel roads stabilized with Morton Salt give more service per dollar than roads built by any other method. (Savings in aggregate alone more than pay for the salt.) You get smooth, durable, water-repellent surfaces that require minimum maintenance.

Stabilizing the base course of primary roads with Morton Salt helps prevent the 9 out of 10 road failures which result from faulty foundations.

. . . for more details circle 221, page 16



Send for this free book on how Morton Salt helps you build better roads at far less cost! *Mail this coupon today!*

MORTON SALT COMPANY
Industrial Division, Dept. RS-6
120 So. LaSalle Street, Chicago 3, Illinois

Please send me your free booklet on salt stabilized roads.

Name_____

Title_____

Address_____

City_____ County_____ State_____

S-M-O-O-T-H A-C-T-I-O-N L-I-F-T...

with Power to Spare!

LIGHTWEIGHT HERCULES "SINGLE FRONT-MOUNT" TELESCOPICS GIVE MORE PAYLOAD PER TRIP!

Three new models (11, 16 and 20 tons, capacity) *legally* permit an extra 1000-1500 pounds additional payload per trip, with bodies from 10 to 15 feet long! Hercules TELESCOPICS weigh less—put more load on the front axle . . . permit additional payload . . . reduce hauling cost per ton . . . result in more profit for you!

HERCULES SINGLE FRONT-MOUNT TELESCOPICS ARE THE STANDARD OF THE INDUSTRY!

Better Weight Distribution
Increased Capacity
Improved Dumping Stability
Safer Operation
Less Maintenance
More Payload

HERCULES 1905 1955 50th ANNIVERSARY

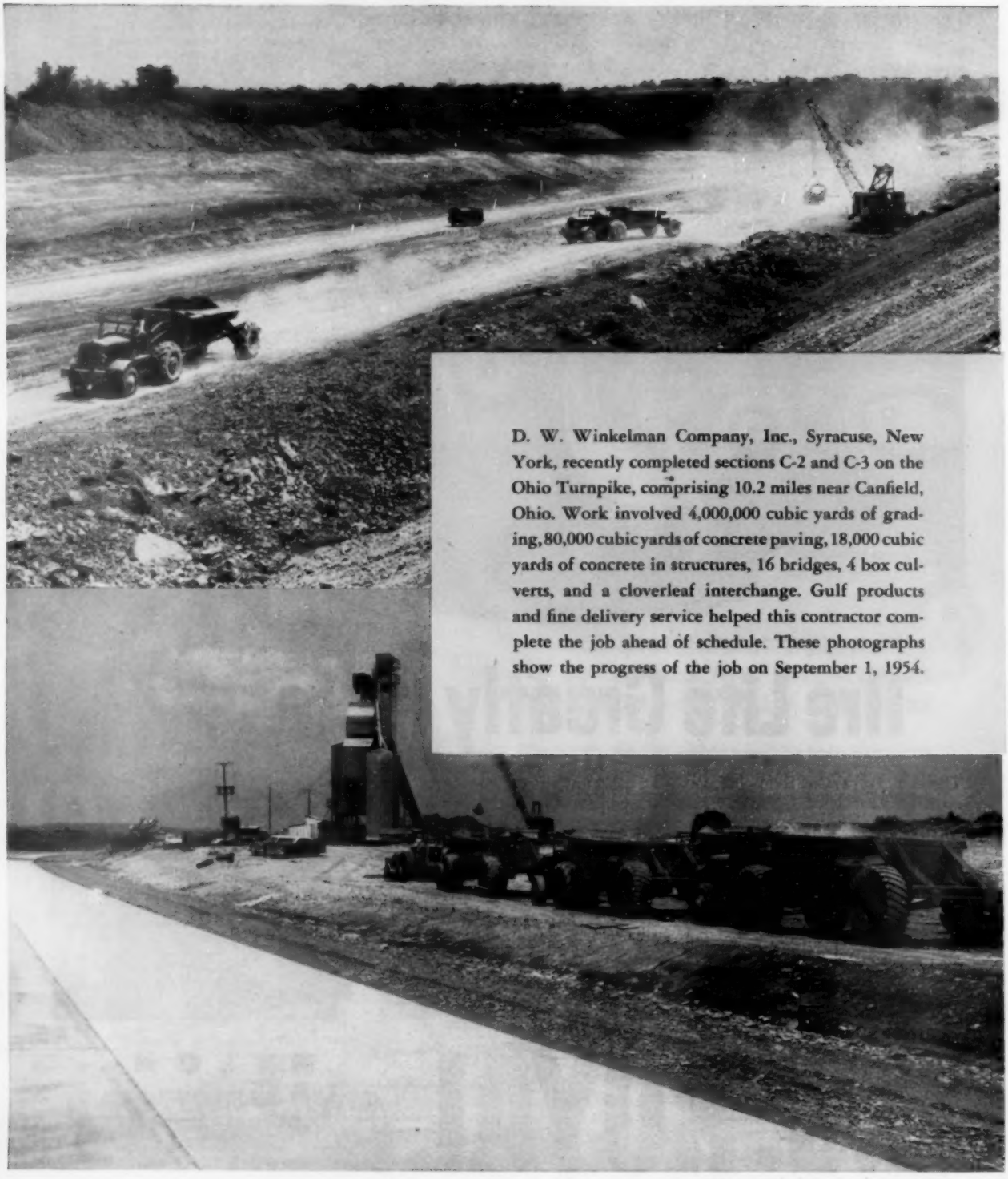
UNISTEEL BODY CO., *A Division of Hercules, producers of Standard and Custom Van Truck Bodies*

5502

Buy from the line of strongest design • **HERCULES STEEL PRODUCTS CORPORATION, GALION, OHIO**

. . . for more details circle 199, page 16

GULF PRODUCTS



D. W. Winkelman Company, Inc., Syracuse, New York, recently completed sections C-2 and C-3 on the Ohio Turnpike, comprising 10.2 miles near Canfield, Ohio. Work involved 4,000,000 cubic yards of grading, 80,000 cubic yards of concrete paving, 18,000 cubic yards of concrete in structures, 16 bridges, 4 box culverts, and a cloverleaf interchange. Gulf products and fine delivery service helped this contractor complete the job ahead of schedule. These photographs show the progress of the job on September 1, 1954.

. . . for more details circle 196, page 16

Steel Erection...

Boom lengths up to 80′, with tip extension if required. Optional fluid coupling, power operated drum clutches and direct drive with optional power load lowering, combine to permit smooth, precision work. Truck crane has folding boom for quick, easy moves in traffic.

Drainage Canals...

Faster swings, smoother operation, *plus* self-cleaning crawlers for marshy terrain, add up to more work daily when used as dragline or clam. Low-mount, back-hitch gantry offers all the advantages of high gantry when long crane booms are needed for extra long reach.

Foundation Borer...

Only Gar Wood offers this new, profit making tool! Combines boring and belling into one streamlined operation for low cost construction of unreinforced foundation footings, caissons, piers, piles, wells, wall supports, etc. Factory installed to order. Completely convertible.

ASK FOR A DEMONSTRATION

Gar Wood

SHOVELS-CRANES TRENCH HOES

. . . Distributors throughout the country will gladly show you how Gar Wood performance puts profits in your pocket!

GAR WOOD INDUSTRIES, INC.

WAYNE, MICHIGAN

No. 551

. . . for more details circle 189, page 16

take a look at a loader that "Measures Up" to your requirements

TRACTOMOTIVE
TL-10 TRACTO LOADER

It's built as an industrial wheel loader from the ground up! Has years of HYDRAULIC TORQUE CONVERTER experience "under its bucket." Brings you the added advantages of a CLUTCH-TYPE TRANSMISSION which eliminates most gear shifting. Saves time maneuvering with short turning radius and bucket-over-drive-wheels design. Powered by the new Allis-Chalmers POWER-CRATER engine — high-octane performance on regular gasoline.

Has one-cu-yd bucket, 63-brake hp, weighs 11,700 lb! You get added versatility with interchangeable attachments—1½-yd Light Materials Bucket, Lift Fork, Crane Hook, Backfiller Blade.

Ask your Allis-Chalmers Industrial Tractor Dealer for an on-the-job demonstration. Take a look at a loader that measures up to your requirements.

"MEASURES UP" GETTING LOAD because there is quick, positive crowding action — no slow, mushy starts. The Tractomotive Hydraulic Torque Converter Drive multiplies engine torque THREE TIMES . . . and there is the traction you need to take advantage of this extra torque with ample weight and big driving wheels. Result — heaping loads, fast!

"MEASURES UP" ON MANEUVERING Works in areas that would normally accommodate only lower capacity machines. Turning radius is only 11 ft at tip of bucket. You can go into a 10-ft bin from a 9-ft aisle! Bucket over drive wheels utilizes weight of load for greater traction . . . eases weight on rear steering wheels. Result — maneuvering time saved, production time gained!

"MEASURES UP" DELIVERING LOAD There is fast getaway, fast delivery of load with the combined advantages of the Clutch-Type Transmission and Hydraulic Torque Converter Drive. A single lever controls backward and forward operation. Highest possible travel speed in selected gear range is automatically obtained through the torque converter. Result — shifting time saved, travel time gained, more trips made!

SEE THE LATEST IN 4-WHEEL DRIVE EXCAVATOR-LOADERS, TOO!

Tractomotive TL-12 Tracto-Loader

A combination of advantages makes it outstanding on excavating-loading . . . has a 1⅛-cu-yd Tip-Back Bucket, 4-Wheel Drive, Hydraulic Torque Converter Drive, Clutch-Type Transmission and Rear Wheel Power Steering. But see for yourself . . . on your job. Ask your Allis-Chalmers dealer for a demonstration.

POWER-CRATER is an Allis-Chalmers trademark.

SOLD AND SERVICED BY YOUR ALLIS-CHALMERS INDUSTRIAL TRACTOR DEALER

TRACTOMOTIVE

Tracto-Loaders • Tracto-Shovels • Side Booms and Hydraulic Rippers for Allis-Chalmers Crawler Tractors • Loader and Shoulder Maintainer for Allis-Chalmers "D" Motor Grader

TRACTOMOTIVE CORPORATION • DEERFIELD, ILLINOIS

here's the backbone of the highway...

CLINTON WELDED WIRE FABRIC

Embedded in the concrete pavement, in the base course or in the asphaltic concrete surface, Clinton Welded Wire Fabric is the steel reinforcement that literally holds the highway together. The heavy, welded wires give positive mechanical anchorage of the concrete which means better load distribution and controls cracking.

Clinton Welded Wire Fabric is available in a wide variety of gauges and spacings for all reinforcing requirements. It meets all A.S.T.M. and A.A.S.H.O. specifications.

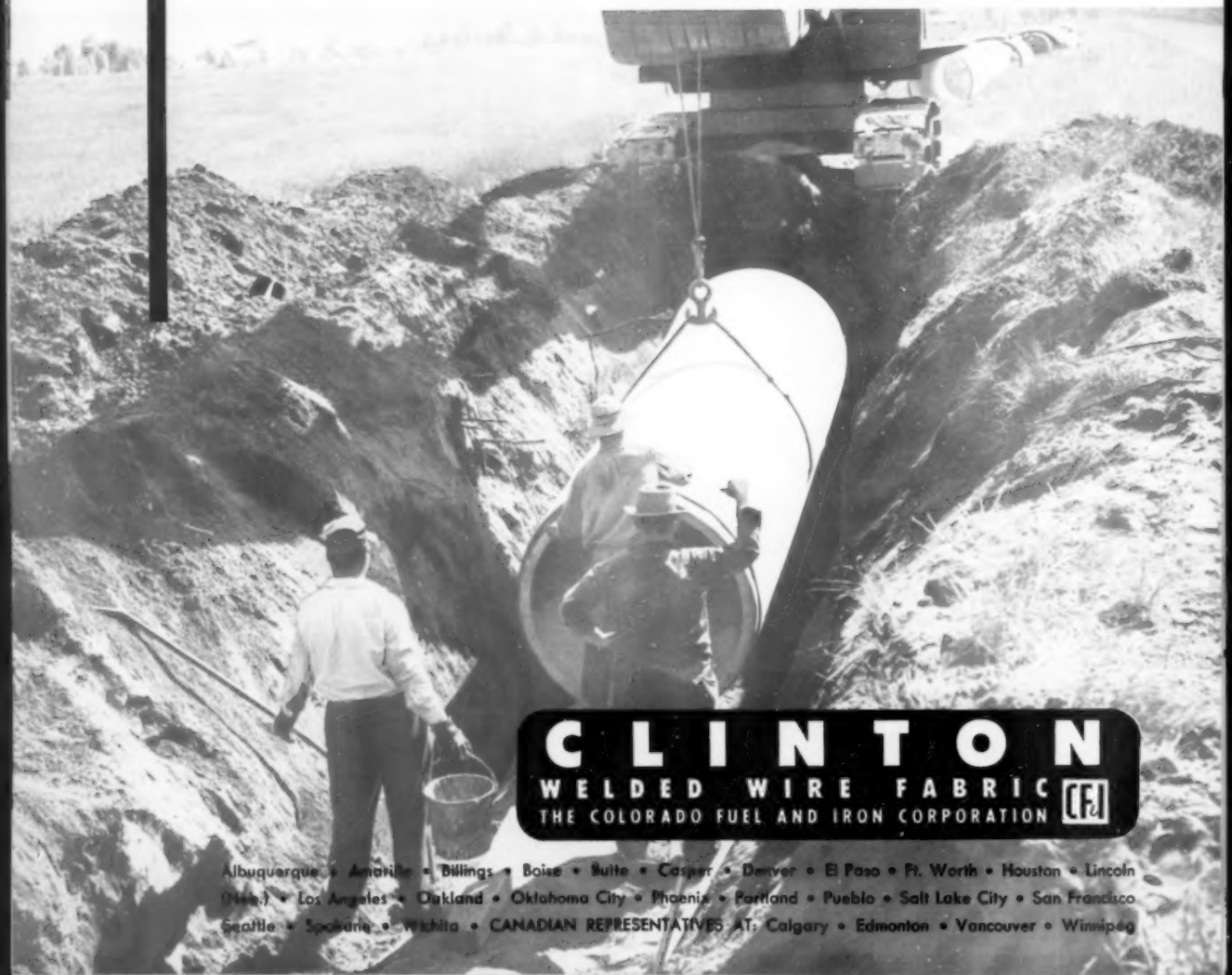
THE COLORADO FUEL AND IRON CORPORATION, DENVER AND OAKLAND · WICKWIRE SPENCER STEEL DIVISION, NEW YORK

here's the backbone of concrete pipe...

CLINTON WELDED WIRE FABRIC

Concrete pipe reinforced with welded wire fabric has the structural strength and freedom from corrosion necessary for maintenance-free pipe systems. Whether for new construction or for repair, when you specify concrete pipe reinforced with Clinton Welded Wire Fabric, you have assurance of a well-built job and a minimum of expense in the future.

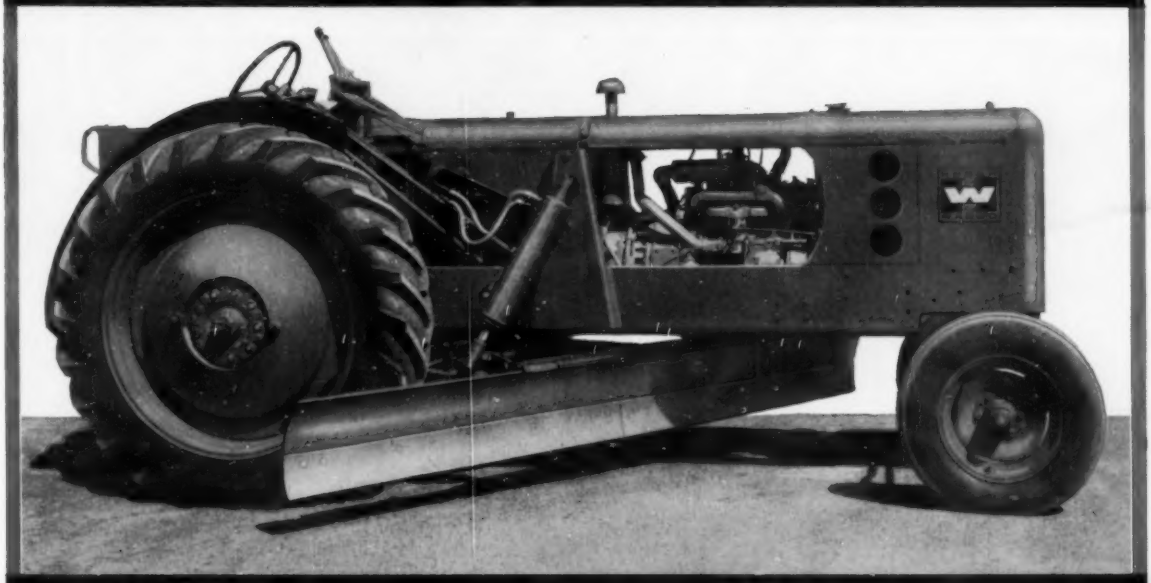
Clinton Welded Wire Fabric meets all A.S.T.M. specifications and is available in the complete range of gauges and mesh sizes.



CLINTON
WELDED WIRE FABRIC
THE COLORADO FUEL AND IRON CORPORATION CF&I

Albuquerque • Amarillo • Billings • Boise • Butte • Casper • Denver • El Paso • Ft. Worth • Houston • Lincoln (Neb.) • Los Angeles • Oakland • Oklahoma City • Phoenix • Portland • Pueblo • Salt Lake City • San Francisco Seattle • Spokane • Wichita • CANADIAN REPRESENTATIVES AT: Calgary • Edmonton • Vancouver • Winnipeg

NEW HUBER-WARCO MAINTAINER



NOW WITH TORQUE CONVERTER

The newly designed Huber-Warco Maintainer, with torque converter, is truly a versatile machine. Construction and highway maintenance problems are handled quickly and efficiently with the Maintainer.

This sensational performer will out-perform many machines that are larger, heavier, more costly, slower, more expensive to operate, and more limited in use.

With hydraulically controlled attachments, the Huber-Warco Maintainer will perform service as a bulldozer, lift-loader, side dozer, berm leveler, broom, patch roller, mower or snow plow.

See A Demonstration of These Important Features

- 45½ H.P. — with plenty of reserve strength for the toughest jobs.
- Torque Converter — reduces shock loads — prolongs the life of the machine. Picks up and carries loads smoother and faster.

Automatically adjusts vehicle speed to meet varying load conditions.

Engine won't stall — regardless of grade.

- All controls within easy reach of the operator.
- Weight of 6250 lbs. — 7205 lbs. with calcium chloride in tires. Enough weight for all maintenance jobs.
- Working speeds range from 1.7 to 8 m.p.h. Travel speed is 21 m.p.h. for quick movement from job to job.
- 9′ Power Sliding Moldboard is standard.
- Hydraulic controls govern movement of the blade and all attachments.

SEE YOUR NEAREST HUBER-WARCO DISTRIBUTOR

HUBER W WARCO

HUBER-WARCO COMPANY

MARION, OHIO, U. S. A.

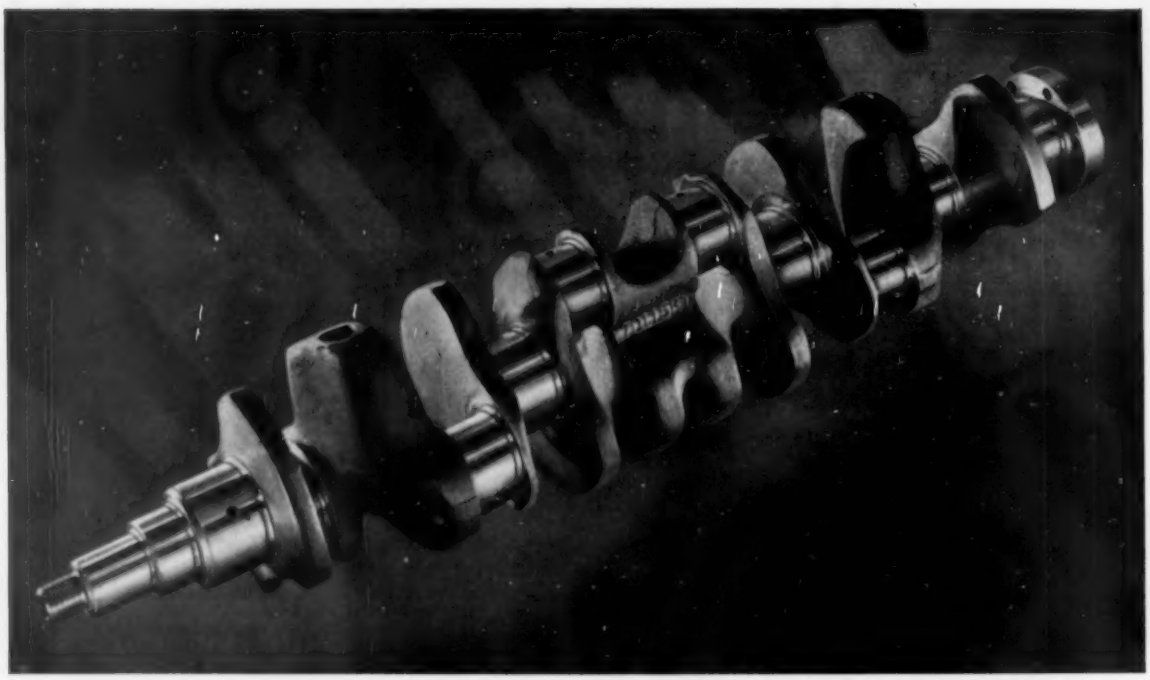
Road Machinery

CABLE ADDRESS: HUBARCO

ROAD ROLLERS • MOTOR GRADERS • MAINTAINERS • GRINDERS

. . . for more details circle 202, page 16

A truck engine needs a "backbone" like this—



From fiery forges and precision machines come extra-strong INTERNATIONAL crankshafts. Those used in light-duty models are 17% heavier than the average of comparable forged or cast alloy 6-cylinder designs—for maximum strength and rigidity, long life.

to save you the BIG money

Crankshafts are just one example of INTERNATIONAL all-truck engineering that saves you the *big money*.

Of the five leading makes, only INTERNATIONAL builds a complete line of models that are *all-truck* . . . with no automobile engines or components asked to do a truck job.

You save the most with an INTERNATIONAL that's *all-truck built* to last longer. It earns its keep in lower over-the-years operating and maintenance cost. It pays for itself in use. It saves you—earns you—the *big money*.

Keeping costs down has made INTERNATIONAL the heavy-duty leader for 23 straight years. Let your INTERNATIONAL Dealer or Branch show you the right INTERNATIONAL for your job—built to save you the BIG money.

There's an INTERNATIONAL *exactly right* for every construction job—*all-truck built to save you the BIG money*. 200 basic models—4,200 to 90,000 lbs. GVW, conventional and COE, 4-wheel, 6-wheel, four-wheel drive. World's widest choice of power and power transmission options.

INTERNATIONAL HARVESTER COMPANY • CHICAGO

INTERNATIONAL® TRUCKS

All-Truck Built to save you the BIG money!

Top TV Comedy! Ronald Colman and Benita Hume in "The Halls of Ivy," CBS-TV, Tuesdays, 8:30 p.m., EDT

International Harvester Builds **McCORMICK®** Farm Equipment and **FARMALL®** Tractors...Motor Trucks...Industrial Power...Refrigerators and Freezers

. . . for more details circle 205, page 16

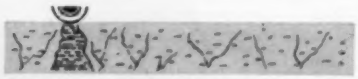
3 BASIC REASONS WHY
STERLING ROCK SALT STABILIZED ROADS
Wear Better, Longer . . . with Less Maintenance!

1. Greater Compaction Means Greater Density!

NOT THIS . . . Without salt, ingredients of the mix remain "loose." Clay binder cannot repel moisture. Excess rain makes rivulets. Dried out, they leave weakening crevices.

BUT THIS . . . With salt, you get better compaction. Brine film is thinner than water, allowing tighter bond of the whole mix. Clay, with brine, repels excess rain at surface. No rivulets. No weakening crevices.

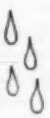
2. Greater Load Transference Means Longer Road Life!



NOT THIS . . . Unsalted road. Wheel of loaded truck puts a great weight on one point of surface. Roadbed supports load **vertically** . . . by only the structure directly beneath it.

BUT THIS . . . Salted road. Because of greater compaction, same load is diffused **horizontally.** Strain is spread outward and downward to about 40 inches at base to each surface inch.

3. All-Weather Resistance Means Lower Maintenance Costs!



EXCESS MOISTURE. Binding materials are not washed out. Clay, with brine, forms colloidal jelly. Repels excess rain, keeps it from weakening structural strength of mix.

EXCESS DRYNESS. Salt recrystallizes. Fills voids. Holds clay binder. Forms protective shield which retains some moisture in mix, resisting suction-like action of traffic.

FREEZING. Salt lowers freezing point. Frost does not penetrate. Prevention of below-surface freezing helps eliminate spring "heave" and pot-holing.

"Nature's own Soil Stabilizer"

For Base . . . Surface . . . and Shoulder Stabilization . . .

STERLING ROCK SALT

INDUSTRIAL DIVISION
INTERNATIONAL SALT COMPANY, INC., SCRANTON, PA.

. . . for more details circle 206, page 16

FREE PAMPHLETS! Up-to-the-minute methods of highway construction and maintenance.

International Salt Co., Inc., Industrial Division, Scranton 2, Pa.

☐ Please send Road Stabilization literature.
☐ Please have representative call.

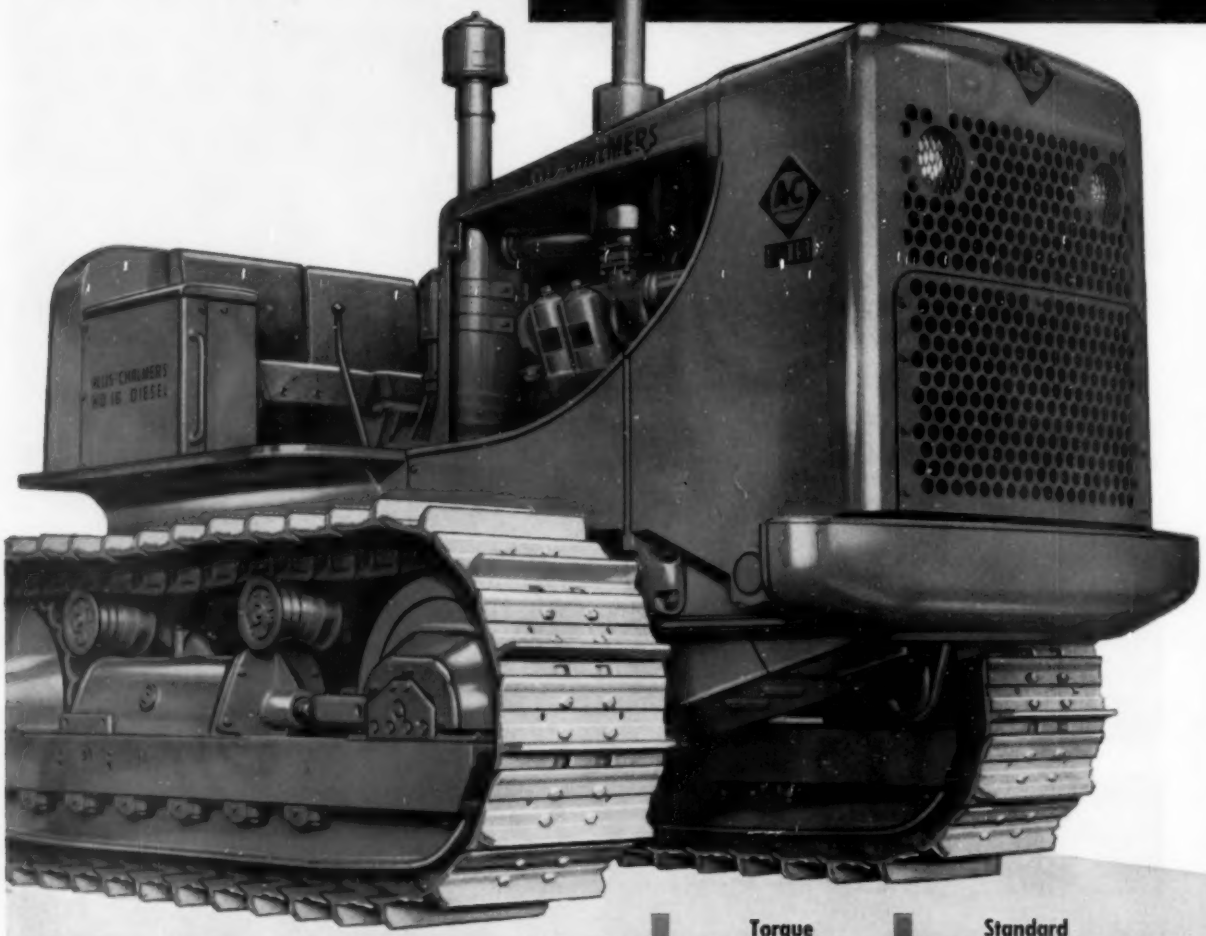
Name_____

Company_____

Street_____

City_____ Zone____ State_____

Allis-Chalmers presents the NEW HD-16



Your choice of two outstanding drives

	Torque Converter Drive	Standard Transmission Drive
Horsepower	150 net engine hp	131 belt hp
Weight	31,600 lb	31,500 lb
Drawbar pull	up to 60,000 lb*	up to 35,945 lb*

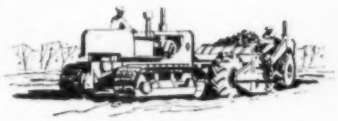
*Limited, under normal tractive conditions, to 90 percent of total weight of tractor and mounted equipment.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

NEW STANDARDS OF PERFORMANCE

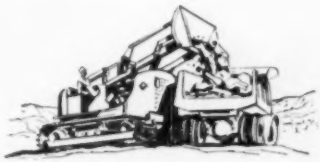
for a wide range of heavy-duty work

Set your sights on an HD-16! This big new tractor not only brings you *more* power for bigger jobs . . . it makes more effective use of horsepower, with a brand new Allis-Chalmers diesel engine and your choice of two new drives — the job-proved torque converter or the easy-shift standard transmission. Either way, the HD-16 brings you a new high in tractor-operator efficiency . . . a new high in work done under even the toughest conditions.



NEW STANDARDS OF DEPENDABILITY AND LONG LIFE

under *all* conditions!



The HD-16 follows the Allis-Chalmers *advanced basic design*, with such important features as its all-steel, Box-A main frame and one-piece steering clutch and final drive case . . . straddle-mounted final-drive gears with tapered roller bearings . . . unit construction . . . simplified lubrication and service designed with *better* maintenance in mind. What's more, it is newly engineered throughout to provide big safety factors in all components . . . plus outstanding new features like the new Allis-Chalmers heavy-duty diesel engine, new "wrap-around" radiator guard, husky new transmissions, new true-dimension track, and many others.

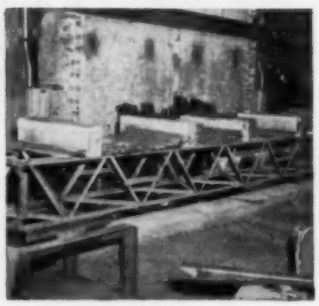
All in all, the new Allis-Chalmers HD-16 brings you an outstanding combination of performance and long life with both mounted and drawn equipment . . . a higher rate of production, more working time, more work done, LOWERED JOB COSTS. You OWE it to yourself to get all the facts now from your nearby Allis-Chalmers dealer.

. . . for more details circle 162, page 16

REDUCE HANDLING COSTS.....

the quickest way to

HELTZEL-OHIO INCLINED AND SHUTTLE CONVEYERS make the handling of vast amounts of materials fast and economical. Before you buy any equipment let Heltzel-Ohio specialists look over your operation and estimate a complete modern day system.



GREATER STRENGTH for LONGER LIFE is the story behind Heltzel-Ohio's special A-frame. Fully stress relieved, most parts are fabricated at the factory under ideal conditions. Unitized, it sets up fast—will last longer.

Thoroughly proved under "back-breaking" loads, every Heltzel-Ohio conveyer section must pass rigid weight tests far in excess of anything it will ever have to carry in the field.

ECONOMICAL SMALL SPACE HANDLING is possible with the discriminate use of switchback conveyers. In a number of cases Heltzel-Ohio engineers have devised 180° or full switchbacks to get maximum use of the space at hand.

TUNNEL CONVEYERS feed from the bottom of the stockpile to cut handling to a minimum. Special Heltzel-Ohio tunnel gates make this system foolproof. Controlled from central panel.

Greater Profits

Heltzel-Ohio Custom Aggregate Handling Systems slash costs for both large and small operators!

ECONOMICAL HANDLING FOR SMALL OPERATORS is a Heltzel-Ohio specialty. Our engineers have cut costs for hundreds of small tonnage operators with simplified, inexpensive, easily controlled systems.

The one place in your operation that you can cut costs without cutting quality is the handling of materials. The research of one leading publication pointed up the fact that 8 out of 10 contractors and yards could realize greater profits simply by bringing their handling equipment up to date.

In a recent check one operator looked over his figures and found it cost him in excess of 28 cents to handle the materials needed for a yard of concrete. He called in Heltzel-Ohio engineers who devised a system that cut this cost to approximately 4 cents a yard. The savings quickly paid for the equipment and now enables him to sell top quality at competitive prices and with much faster service.

Consider your operation. Let a Heltzel-Ohio man show you how modern equipment will pay for itself in short order. How it will put you in the best competitive position possible. And when you think of materials handling, remember Heltzel-Ohio engineers are specialists —designing and building materials-handling equipment specifically for the concrete industry. Get the last word from those who know. Send in the coupon today!

SPECIALISTS IN HANDLING SYSTEMS FOR THE CONCRETE INDUSTRY

HELTZEL *Ohio*

HANDLING SYSTEMS

32000 THOMAS ROAD • WARREN, OHIO

Heltzel-Ohio Handling Systems Div.
Heltzel Steel Form & Iron Co., 32000 Thomas Road, Warren, O.

I'm interested in reviewing my handling operation. I would like to have a Heltzel-Ohio engineer look it over at no obligation.

Name.....

Company.....

Address.....

City.....State.....

. . . for more details circle 198, page 16

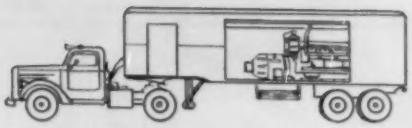
CATERPILLAR ANNOUNCES

A NEW LINE OF PORTABLE ELECTRIC SETS

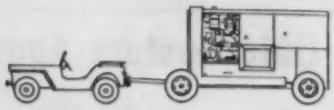
Dependable electric power—where it's needed, when it's needed

USE CAT PORTABLE ELECTRIC SETS

- When you're on a remote location with no high line power available.
- When there are delays in running power lines to your job.
- When power failures cause you to lose working time.
- When "demand" charges eat up profits.



CAT* Portable Electric Sets are now available in 9 models, 30 to 315 KW



These Caterpillar Portable Electric Sets are ready to serve you in emergency or full-time operation. They are available in all the usual voltages, 50 or 60 cycle.

Each is a complete unit, with cooling system, fuel tank and switch-gear, mounted on skids, semi-trailer or full trailer, ready to be moved anywhere you need it at a moment's notice. Even the biggest trailer-mounted set is well within highway weight and size restrictions.

The units are easy to hook up, easy to operate. They deliver steady voltage and require a minimum of supervision. Low fuel and maintenance costs are added advantages.

In this new line of portable electric sets, there's one that will exactly fit your needs. Get complete information from your Caterpillar Dealer. Call him today.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

THE NEW STANDARD OF PORTABLE ELECTRIC POWER

CATERPILLAR TRACTOR CO., Peoria, Illinois, U. S. A.

Please send me further information on Cat Portable Electric Sets.

Name_____

Company_____

Street_____

City_____ Zone_____ State_____

. . . for more details circle 172, page 16

World's Biggest Widening Job — Jersey Turnpike Being

LET OUT AT SEAMS

Five contractors participating in 61.5-mile $26 million Jersey Turnpike widening project, which will be completed in single season under unique procedures entailing over one million dollars for traffic maintenance and protection

YOU'VE never seen a widening job like the one in progress along the New Jersey Turnpike. In a little over eight months, five contractors with equipment strewn along sixty-one miles of pike, have the task of moving over 3,000,000 cu. yd. of earthwork of all kinds, placing over 350,000 lin. ft. of drains, extending innumerable culverts, widening 34 bridges, placing approximately 1,-010,000 sq. yd. of heavy pavement and base, rebuilding shoulders, handling countless signs, barricades, flares and cones, and performing other contract items that go with this job.

With a final completion date of December 1, for most of the work*, these firms must wrap up a high-speed job, bristling with novel problems and requirements, chief of which is the contractor's responsibility for avoiding traffic mishaps and maintaining traffic averaging 8,000 to 20,-000 vehicles per working day.

What are some of the design features of this unusual job? What are the specifications and working procedures planned by the contractors? Especially, how will traffic handling on such an unprecedented scale be managed? ROADS AND STREETS presents the following summary, the first in a series. The job is singled out for intensive reporting, it is believed to be of broadest interest among contractors and highway building agencies.

This widening project spotlights particularly the need for increasing the traffic capacity of major arterial facilities in many states. And it is remindful of the growing importance of traffic handling and protection as a bid item on road construction and repair jobs, and of the swiftly evolving techniques of flagging, signing, barricading and overall management of the traffic handling aspect.

The turnpike authorities abruptly reached a decision to widen the road late in 1954 after reviewing the traffic growth. The need for more lane capacity was seen to be imperative, due to the impending completion of traffic-generating links and spurs. These included the connector with the Pennsylvania Turnpike near Bordentown, the $114 million 8-mile spur from Newark Airport interchange over Newark Bay to the Holland Tunnel and a third Lincoln Tunnel tube under the Hudson into New York City. Funds to finance the widening were obtained by a $34 million bond issue sold in March.

The widening when completed will provide continuous 6-lane travel over the northern 83.3 miles of the turnpike. A 22-mile stretch south from the Lincoln Tunnel interchange op-

*56 miles to be done by December 1. The northern section shortly thereafter.

● First dirt being moved for widening New Jersey Turnpike near northern end. Union Building and Construction Company's D Tournapulls and Tournadozer are moving shoulder material from foreground for widening overpass fill in distance.

● Example of conspicuous signing required when one lane is temporarily closed off.

posite Manhattan to a point south of Woodbridge was originally built with 6 lanes (8 lanes through Elizabeth.) The widening includes a 5.4-mile section of existing 4-lane dual roadway at the northern end. The project picks up again below Woodbridge and continues for 56 miles to the Camden Interchange near Philadelphia. The southern 35-mile section carrying relatively lighter traffic will remain as a 4-lane dual road for the present.

The widening will consist in general of removing the existing 10-ft. outer shoulder and adding a third 12-ft. pavement lane and a new 12-ft. penetration macadam shoulder. Cross road bridges overpassing the turnpike will not require alteration, since sufficient room for a third lane was provided in their original construction. However, all bridges carrying the turnpike over streams or cross traffic will require widening. Several interchanges will need important revisions to accommodate the third lane, the Newark Airport interchange particularly involving complex design problems.

In general the job will be simply to move back the existing ditch line and widen the embankment or cut slopes. In some instances, where cut slopes are in unsuitable material which would require wasting, or in unstable hillsides, the cutting back will be reduced or largely eliminated by substituting storm drains or combination underdrains and storm drains in lieu of an open ditch.

Drainage extension is a major job throughout the project; hundreds of thousands of feet of pipe of varying sizes will be installed.

Awarded in March

The widening was advertised and awarded in March, in five sections, as follows, from north to south.

Contract W-5, between George Washington Bridge and Lincoln Tunnel interchanges; 5.44 miles. To Union Building and Construction Co., Passaic, N. J. $2,733,376.

Contract W-4, from Woodbridge south to Cranbury; 16.88 miles. To Savin Construction Co., East Hartford, Conn. $5,707,338.

Contract W-3, Cranbury to Pennsylvania Turnpike connector junction; 22.38 miles. Reid Contracting Co., Woodbridge, N. J. $7,303,287.

Contract W-2, Pennsylvania Turnpike connector to North Camden; 15.97 miles. S. J. Groves & Sons Co., of Woodbridge, N. J.

Contract W-1. Awarded to Belmont Iron Works at $380,380, furnishing, comprises fabrication and storage of structural steel for bridges to be widened. The 2,100 tons of steel will be stored at the contractor's plant or yard, in readiness for picking up, transporting and placing by the roadway widening contractors.

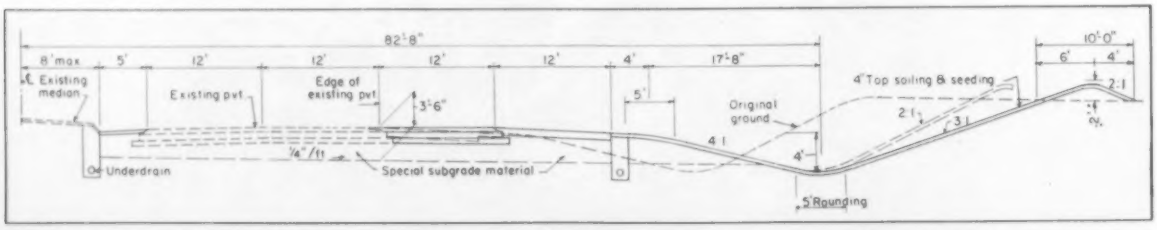
Contracts PE-4 and PE-5, C. J. Langenfelder & Son, Inc., Baltimore, at $1,780,000, and Kingston Bituminous Products Co., Kingston, N. J., at $2,586,000, cover a new interchange and the Pennsylvania Turnpike connector, including 1.8 miles of widening of the turnpike main line in the interval between contract sections W-2 and W-3.

Localized Resurfacing

Also included in the widening project is some localized turnpike roadway resurfacing. The asphaltic concrete pavement on heavy flexible stone base placed during the 1951 season has required no surface patching to date, except for a local area north of Bordentown and areas over the tidal marsh areas in the northern end (where sand drains were installed and a calculated risk of settlement was taken). These areas have been subject to some deformation due to sub-surface settlement. This relatively minor occurrence of settlement is one of the penalties for the extremely rapid construction to meet the opening date, involving in some instances the decision to remove sand drain (overload) more rapidly than was otherwise desirable in order to hasten construction.

The widening contractors having such sections where settlement has taken place will first complete foundation correction and resurfacing of these areas of the existing turnpike roadway, together with the inner shoulder. This restored construction will then be available in matching up the widening work. The resurfacing is required to be completed by July 1 in all instances. The work is being done simultaneously with the beginning phases of grading, drainage and structure work for the widening.

All grading, drainage and structure widening is required to be completed by October 1, paving by November 1, shoulders by November 15, and the entire job by December 1 for all widening contracts. Liquidated damages are set at $500 per calendar day for each of these categories in event of failure to complete the work on time, with $1,000 per calendar day for default on completion of the en-



● Widening cross-section for the Jersey Pike looks something like this, with variations to accommodate local situations.

● (Left): "Danger — Construction Ahead" sign provided in accordance with specifications. (Right): Timber guard rail, a standard precaution when equipment must use shoulders under an overpass. Permanent guard rail will be installed around pier when third lane is completed.

tire Northbound or Southbound lane, and a maximum of $2,000 per day for all categories.

The specification remind the contractor that the turnpike with its heavy flow of 60-mph traffic must observe extraordinary precautions to protect the traveling public as well as his own personnel and equipment. Traffic on the pike is under state police surveillance, but it is the contractor's responsibility to maintain and protect traffic any hazards resulting from his construction operations. Work may be summarily discontinued by the engineers or by the police at any time that they feel traffic is not being properly handled and protected, and work cannot be resumed until the condition is corrected.

The specified noon-to-noon weekends, including Friday - to - Tuesday stoppages over Decoration Day, the Fourth, and Labor Day, and Wednesday-to-Monday over Thanksgiving, will seriously eat into the available time. It will be interesting to observe the degree of equipment utilization and productivity generally on this unique project, and the amount of extra labor and equipment-hours required compared with normal new construction.

Some Provisions

The contractor must submit to the engineer by noon each Friday, a written or graphic report showing the exact limits, by mile posts, of work to be done within 12 ft. of a traveled lane during each day of the coming week. This report will list any special operations or equipment movements anticipated, and give a detailed plan and description of the minimum protective measures to be provided.

No work or movement of equipment is permitted along the project except in daylight hours.

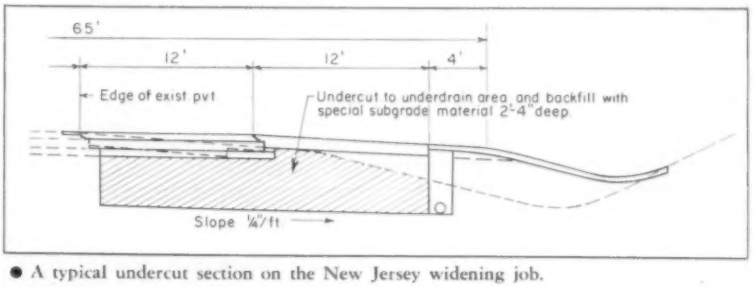
In general, 2-lane traffic in either direction will be maintained. One lane traffic may be permitted briefly over distances not exceeding one mile on written permission from the engineer.

When the contractor needs to utilize the inner shoulder to maintain 2-lane service, he must provide a pavement substantial enough to carry the heavy traffic, if the existing shoulder construction does not already suffice.

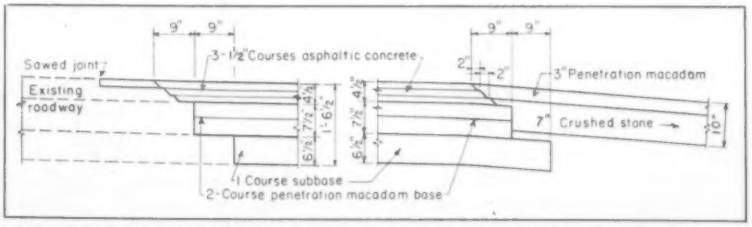
Construction must be planned so that 2-lane turnpike traffic in either direction will be maintained at all times during the period from noon Friday through to noon Monday, and from noon-to-noon of the day before and after holidays. This provision, however, will not prevent the contractor from putting in week-end overtime on work outside properly placed barrier curbs.

During these noon-to-noon periods no work will be permitted at existing interchanges or service areas, or within 12 ft. of a traveled lane unless the work is separated from traffic by a barrier curb of continuous timber construction. No equipment movement or material hauling will be permitted during these periods. Construction work however will be permitted outside the above limits when access is by means other than the turnpike lanes or interchanges.

Contractor equipment traffic is also explicitly set forth. Equipment cannot move against traffic unless separated by a barrier curb, or unless at least 12 ft. from the nearest traveled lane. Equipment must be equipped with yellow extremity flags. Traveling on or across the median is strictly forbidden at all times. Turnarounds of equipment will be permitted under flagman control inside the toll booths at off Turnpike toll plazas on written permission and with 24-hour notice of intent by the Contractor. Transport of bulky or slow



● A typical undercut section on the New Jersey widening job.



● Details of the sawed joint and of the pavement and outside shoulder for the roadway pavement.

● Flagmen by the dozen are to be provided for Union's widening project by a commercial detective agency (Neilson).

equipment on turnpike lanes can also be done only on written permission, with advance notice so that the Turnpike police can cooperate. Crossing of the turnpike traffic stream by contractor personnel or equipment will not be permitted.

At bridges overpassing the turnpike, earthmoving or other construction equipment cannot be moved from one side to another unless it is done along the outer shoulder edge and confined behind a timber barrier curb extending 100 ft. or more in advance of the bridge pier to a point 50 ft. past. Such curbs must be properly flared at night.

Contractor equipment incapable of moving 25 mph or faster will use the turnpike under permit.

All equipment movement is limited to areas outside the traffic delineators unless separated by barrier curbs as noted. Materials cannot be stored within 30 ft. of a traveled lane, again unless the barrier is provided.

In practice, barrier curbs promise to figure importantly in the work, these timbers being placed at times in the shoulder and sometimes on the outer pavement edge where inner shoulder width is properly armored to provide compensating lane width. In preliminary work such as grading, drainage, etc., the aim will be to keep equipment at least 25 ft. in the clear whenever practicable. Whenever such equipment must work closer, a flagman will be on duty.

Protective services and personnel include the following requirements:

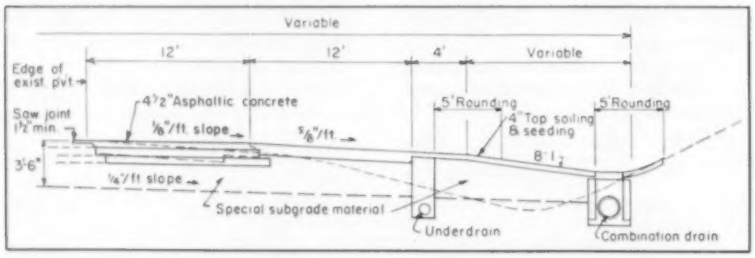
1. At least one full-time traffic protection foreman on duty to supervise the installation, location, transportation, relocation, maintenance and repair of barrier curbs, signs and other protective devices.

2. A night watchman must be on hand at all hours of darkness, equipped with suitable transportation which carries a yellow flashing warning light. He will travel back and forth on the turnpike, reversing his direction by turning at fence breaks, on local roads, or at toll plazas. He must patrol all protective devices at hourly intervals or oftener.

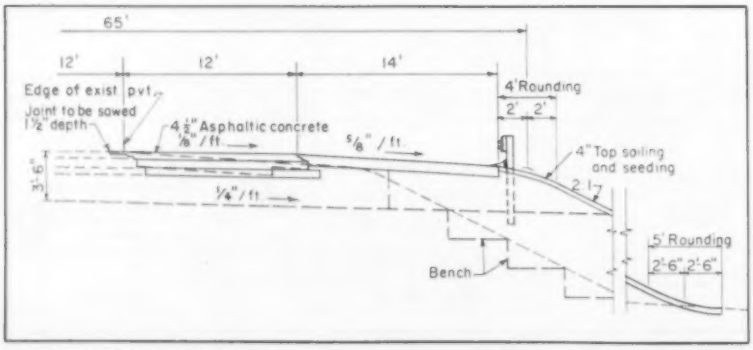
3. The contractor will furnish a 2-way radio for one vehicle for liaison with the turnpike police by the traffic protection foreman by day and the watchman by night and on holidays. This radio is to be independent of any such equipment used by the contractor for his own operations.

4. Uniformed guards will be a big item. Guards are to be assigned, one to each of the following locations: ¼ mile ahead of first construction; ⅜ mile ahead of any activity within 10 ft. of a traveled lane; at each location where equipment enters or leaves the traffic stream; at the entrance and exit ramps of service areas and interchanges under construction; wherever contractor traffic crosses interchange traffic; plus other places when considered necessary.

The number of workers assigned to any task is also considered to have a safety bearing; the engineer has the power to direct the contractor in writing to add to the work force when he deems it necessary to maintain traffic.



● A typical cut section in unsuitable material.



● Section for fills ten ft. or more.

Signs and Protective Devices

Explicit requirements include the following:

1. Advance warning signs reading "Danger — Construction Ahead" are to be placed, one each at a point one mile ahead of the contract, one mile ahead of each construction site (unless sites are less than four miles apart in which case one sign will suffice), and one mile in advance of each bridge under construction unless within two miles of a previous advance warning sign. Signs will have flashing yellow warning lights, and will be placed facing traffic 12 ft. from the traveled lane edge.

2. In advance of each construction site, three signs with appropriate messages must be posted at distances 500 and 1000 and 2000 ft. in advance of each construction site, on each side of the roadway affected.

Where construction is more than 10 ft. off lane, the sign will read "Caution." If within 10 ft., "Reduce Speed." Same for bridge sites. Signs located 12 ft. out from lane edge.

3. Adjacent to construction areas, where construction is between 10 and 25 ft. of a traveled lane edge, a sign must be posted reading "Speed Limit 60" at half-mile intervals, the signs being placed on both sides of the roadway beginning at a point ½ mile in advance. Traffic cones will be placed at 50-ft. intervals along the outside edge of the existing shoulder, to mark a minimum safety zone of 5 ft. width between the markers and the work. Lighted flares at 150 ft. intervals are required at night or during fog.

When construction is within 10 ft. of the traveled lane edge, post signs reading "Speed Limit 35" must be placed at ¼-mile intervals through the work. These are in conjunction with barrier curbs of 8 x 12 in. timbers placed continuously along the lane edge, so as to provide a 2 ft. minimum safety zone between work and curb. The barrier curb must not occupy more than 4 ft. of the traveled pavement unless by written OK of the engineer, and shall separate traffic from all areas of open construction where excavation or other construction has created a hazard.

Flares or 6" x 6" reflective squares will be placed at 150 ft. intervals for night or fog, with metal shields to protect the timber curb from fire damage from the flares.

Where access to the outer shoulder for disabled cars is not possible, signs must be posted at ¼-mile intervals saying "Park Disabled Cars on Median Strip."

Bridge construction within 10 ft. of the traveled way will carry signs reading "Speed Limit 20" located at 500 ft. intervals beginning 1500 ft. ahead.

4. "Resume Normal Speed" signs will notify traffic at appropriate points.

5. One-lane traffic when permitted on written notice also will be the subject of explicit signing orders. These include use of ten striped barricades evenly spaced beginning ½ mile ahead, tapering through the closed-off lane to the point of construction. Directional arrows will be fastened on barricades as required. A flashing yellow light facing oncoming traffic will be mounted on each barricade, and every second barricade will carry the sign "One-Way Traffic," marker cones will be evenly spaced at 50 ft. intervals between barricades, and lighted flares used at night or during fog.

Succeeding reports will describe the construction methods, equipment and progress of the contractors on the New Jersey Turnpike widening work.

Engineering Supervision

The 6-mile section through the marsh at the northern end is under the supervision of Porter, Urquhart, O'Brien & McCreary, consulting engineers of Newark, serving as section engineers on design and supervision. The portion south of Woodbridge is under DeLeuw, Cather and Brill, of New York City.

Charles M. Noble is chief engineer of the New Jersey Turnpike Authority of which W. W. Wanamaker is executive director, with Stanton C. Funk and William J. Delaney, assistant chief engineers, H. W. Goldberger, construction engineer and Edmund R. Ricker, traffic engineer. Howard, Needles, Tammen and Bergendoff are general consultants for the Turnpike Authority.

Editorial

Briefly Noted . . .

The human side of highway engineering made local headlines recently in upper Michigan. The occasion was a ceremony at which Carl F. Winkler, for a quarter of a century County Engineer of Houghton County at Hancock, was given a Distinguished Service Award.

Carl Winkler besides being an excellent highway administrator is a colorful man. Appropriately, Jack Rice, a member of the commission and a local newspaper publisher, summed up the more formal part of the dedication by the following comment: "He's not a Dr. Jekyll-Mr. Hyde nor an Olson and Johnson — he is more a Houdini and Einstein combination — he makes the snow disappear and he's a genius at getting good mileage out of old antiquated equipment. He has the tongue of a mule skinner, the gruffness of a marine sergeant, but underneath all this exterior, 'Wink,' as he is known far and wide, can be as kind and gentle as a mother with a new born babe."

Then Jack Rice went on to pun Carl, who is well known for his many attributes. He said:

"For 25 years our Guest of Honor has Bucked the snow and in all that time he has never been known to pass the Buck.

"He is a lover of Dogs, and a Dog for work.

"He is a man's man and no slouch at a cocktail party.

"He is a diamond in the rough, with a heart of gold."

Roadbuilding can use a lot more fellows like Carl Winkler, who is still going strong and doing a fine job in his county. His colorful character has helped him be a good highway administrator by enabling him to keep the public behind him.

•

Detroit traffic authorities are considering signal lights installed over the new expressways under construction, to be used in emergency to avoid the immense blockade which occurs when expressways are obstructed by wrecks or collisions.

A newspaper editorial, speaking for the motorist, advocated the use of red lights at all expressway entrances involved and orange lights at intervals along the expressway back of the mishap, to be turned on as a means of slowing traffic to a pre-determined speed limit of say 25 mph. Also a flashing orange light was suggested as a means of encouraging drivers to leave the expressway at the first opportunity.

The lights, suggested this editorial, should be actuated by a few master switches in connection with patrol car radios.

Already under discussion in Detroit are the design features of frequent turn-outs and wider shoulder room on urban expressways for vehicles in mechanical distress.

All of which reminds us that urban expressway design is still in a state of transition, and that many of the projects currently under construction, as well as those already in service, are actually obsolete today.

•

What are the seven engineering wonders of the world? The American Society of Civil Engineers has stirred up a lot of publicity in canvassing its members over their ideas of what projects to include. More than 200 outstanding works have been named.

How about our country's Highway System, which hundreds of times over is the biggest engineering "structure" ever built by man.

Roads and Streets in the News

State Road Funds Quadrupled In Past Decade

More than four times as much money was raised in 1955 for highways than in 1945, according to a report covering a decade of highway finance. The report, prepared by the U. S. Bureau of Public Roads, states that while contributions from all sources have increased materially during the period, the quadrupling of total receipts can be attributed chiefly to the increases from state highway-user imposts and borrowings.

As reviewed by the National Highway Users Conference, state highway use tax revenues continue to grow at a rapid rate, with the $3,268 million from this source in 1954 being 11 percent over 1953 totals. Highway use taxes at all governmental levels accounted for $3,318 million last year, or 60 percent of total revenue for highways, exclusive of borrowings, the report states.

The outstanding development of the post-war highway picture, says the report, is the "unprecedented expansion in the credit financing of the highway construction program." In 1954, borrowing on the state level, including toll road and special authorities, amounted to $2,387 million. Toll facility construction accounted for $2,100 million of this total.

During the 10-year period, more than $8,000 million of original highway and street bonds were issued: $5,800 million by the states; $1,500 million by urban places; and $800 million by the county and local rural units. Approximately $4,500 million of these bonds were for construction of toll facilities.

Top $6 Billion

Highway disbursements, which exceeded $6,000 million for the first time in 1954, show the greatest increase in the amounts for capital outlay (construction and costs of rights-of-way). Of the $6,280 million in direct expenditures during the year, $3,856 million was accounted for by capital outlays, or 61 percent. Maintenance expenditures totaled $1,780 million, or 28 percent, with administration, highway police and interest making up the remainder. A total of $341 million was disbursed for retirement of obligations.

The report points out that the "impact of these extremely large expenditures must be viewed in the light of increased costs, however." Since 1945, the highway construction dollar has decreased in purchasing power to where it now takes $211.10 to do what $100.00 would do in 1940 (the base in the report). In 1945, $152.20 would suffice.

Maintenance and operation costs have likewise increased; in 1954 the index stood at 228.1, with 1940 equaling 100.

Based on these data, the BPR report shows that on a 1940 base, capital outlay amounted to $1,328 million; and maintenance, $290 million in 1954. Even on this reduced magnitude, the increase in capital outlays over the 10-year period amounted to 650 percent.

(Editor's Note: The National Highway Users Conference has incorporated these data into a report covering practically the entire modern history of highway finance. Entitled "Highway Revenues and Expenditures, 1921-1954," the report is available on request to NHUC, 966 National Press Building, Washington 4, D. C.)

$700 million program urged for Connecticut

A special state committee has urged that the general assembly adopt a $700 million highway expansion program for the state. This would be in addition to the 127-mile Greenwich-Killingly expressway, now under construction at an estimated cost of $400 million.

The committee of civic leaders headed by a life insurance executive said that the state should plan to finance the program through bonds secured by toll revenues and gasoline taxes. Governor Ribicoff on receiving the proposal reported that he would favor a 2-cent increase in the state gasoline tax, now pegged at 4 cents. Also a toll increase on Merritt Parkway and other toll roads and bridges to help pay for the program. The committee had been appointed early in the year by the governor to study the state's program needs.

The committee urged a change in financing of the Greenwich-Killingly expressway bonds, of which about $100 million have already been sold. Only general obligation bonds would be issued hereafter, and the present financing would be revised, to end the existing lien on the state gasoline tax revenues involved.

● Continuing success is reported with the program of training foreign highway engineers initiated by Ohio State University. All students are graduate highway or traffic engineers, on leave from jobs in their respective countries. Sponsor is the International Road Federation.

● Foreign Highway Engineers at Ohio State University, conferring with Guy Elbin, engineer of Franklin County, Ohio, and Professor E. H. Karrer.

What this exclusive differential does:

In area of overall good footing, LeTourneau-Westinghouse differential allocates power equally to both drive wheels.

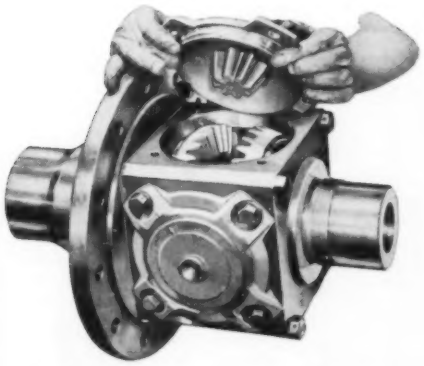
When one wheel hits a soft spot and begins to slip, differential automatically transfers up to 4 times its power to wheel on firmer footing.

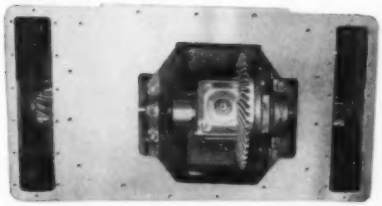
As slipping wheel starts to grip, power begins to equalize, until on firm ground, both drive wheels pull evenly.

On a curve, differential automatically adjusts wheel speeds for smooth, sure control. There's power on both drive wheels at all times.

Why you get more yards when

power is automatically transferred to wheel on firmest footing





With Tournapull differential, as soon as one wheel hits a slippery spot and tends to spin, idler pinions are forced outward against friction surfaces. This automatically slows the slipping wheel, and transfers up to 4 times its tractive effort to wheel on firmer footing. Neither wheel will spin independently until the 4 to 1 ratio is exceeded.

1. Since power is transferred where it can be best used, you pull through easily where other rigs bog down . . . haul loads where many can't pull through empty.
2. Wheel "spinning" is practically eliminated . . . tires don't cut in.
3. You can work in almost any material . . . mud, loose sand, snow . . . keep rigs earning in what is normally considered shut-down weather.
4. You can extend your work season earlier in spring, later in fall.
5. You ride curves easier, safer, faster because differential equalizes tire travel, gives you better traction and better control.
6. Tire wear is reduced through elimination of slipping, spinning.
7. There is less gear shifting necessary, less loss of momentum . . . you get faster cycles.
8. Power-transfer differential works automatically at all times . . . no control action needed . . . no special maintenance is required.

Investigate this revolutionary and exclusive power-transfer differential. It is standard on all LeTourneau-Westinghouse prime-movers . . . makes a major contribution to their ability to work a longer season, cut weather delay, haul larger loads through tough going, gives a faster cycle on any kind of footing.

Ask for a demonstration to see for yourself how this power-transfer differential can make more money for you. Why not do it now?

This power-transfer differential is used on all sizes of LeTourneau-Westinghouse electric-control Tournapull-scrapers, rear-dumps, bottom dumps, flatbeds, cranes, and logging arches.

Tournapull—Trademark Reg. U.S. Pat. Off. P-780-G-b

A Subsidiary of Westinghouse Air Brake Company

LeTourneau-Westinghouse Company

PEORIA, ILLINOIS

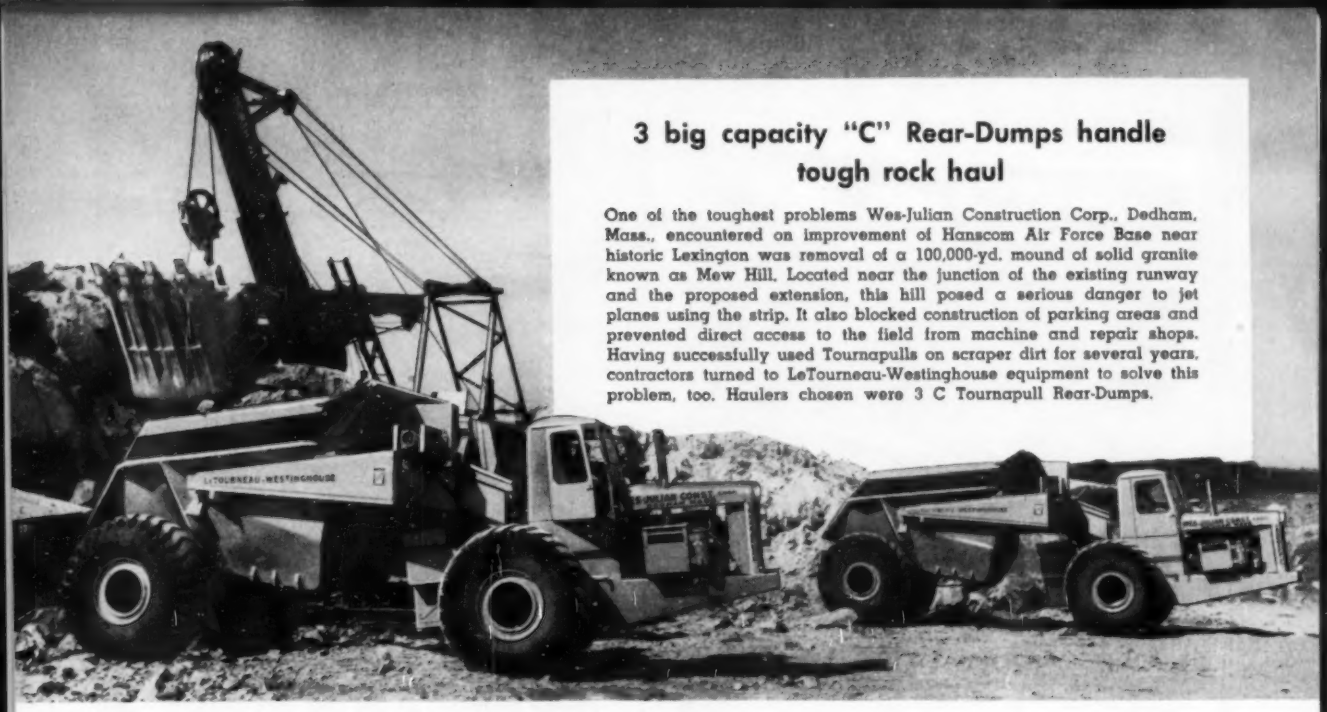
MAKE WAY FOR THE HIGHWAY

Keep clearing schedules on time and save money doing it. Get the dependable, easy-to-handle Homelite chain saws. They have more power per pound than any other chain saw ever developed. They rip through 20 inch trees in 20 seconds, fell the big ones five feet or more in diameter with ease. But most important they stand up under the grind . . . they keep cutting day after day, from morning to night. Down time and costly job stoppages are practically eliminated . . . maintenance costs are reduced to a minimum. Ask your Homelite representative for a free demonstration or write for folder today.

HOMELITE CORPORATION

7006 Riverdale Avenue, Port Chester, N. Y.

. . . for more details circle 200, page 16



3 big capacity "C" Rear-Dumps handle tough rock haul

One of the toughest problems Wes-Julian Construction Corp., Dedham, Mass., encountered on improvement of Hanscom Air Force Base near historic Lexington was removal of a 100,000-yd. mound of solid granite known as Mew Hill. Located near the junction of the existing runway and the proposed extension, this hill posed a serious danger to jet planes using the strip. It also blocked construction of parking areas and prevented direct access to the field from machine and repair shops. Having successfully used Tournapulls on scraper dirt for several years, contractors turned to LeTourneau-Westinghouse equipment to solve this problem, too. Haulers chosen were 3 C Tournapull Rear-Dumps.

Solving a rock hill problem on $3,885,000 Air Base job

Rear-Dumps usually were loaded in 4 to 5 passes of 2½-yd. Northwest shovel. Each load averaged 18 tons. Because one "C" carried as much as could 3 to 4 average dump trucks, often used on jobs like this, Wes-Julian needed fewer haulers and fewer operators. All-steel body construction also reduced maintenance. Capacity of this Model "C" Rear-Dump, without sideboards, is 18 tons. Newest "C's" carry 22 tons.

Leaving the shovel, these Rear-Dumps accelerate quickly . . . go rapidly over both well-maintained haul road and soft fill. Runway is being extended 2300'. Pavement will be 200' wide with 200' shoulders on either side. Several 75' wide taxiways to be constructed include one 1000' long and another 1500' long. At the eastern end of the 150 acre air field job, Wes-Julian will also construct a 250' long blast pad.

Fill is dumped at end of runway extension. Note how body swings below and behind rear wheels. This keeps material from piling under unit . . . combined with front-wheel drive, allows safe dump over edge of fill or steep banks when necessary. When Mew Hill has been leveled, Rear-Dumps will haul another 100,000 yds. of rock, hardpan, peat, and clay from other borrow locations to grade for 6 miles of connecting highways.

Turning to dump in tight quarters of this ditch is no problem for C Tournapull Rear-Dump. Despite overall length of 29', "C's" can make non-stop 180° turn in space only 27' wide. In dump position, this remarkable unit requires only 21' for a non-stop U-turn. Steer works independently of footing through geared kingpin that connects trailing unit with prime-mover.

Tournapull—Trademark
Reg. U.S. Pat. Off. R-746 H-b

For more information on Tournapull Rear-Dumps (or interchangeable scrapers and bottom-dumps) please write or call:

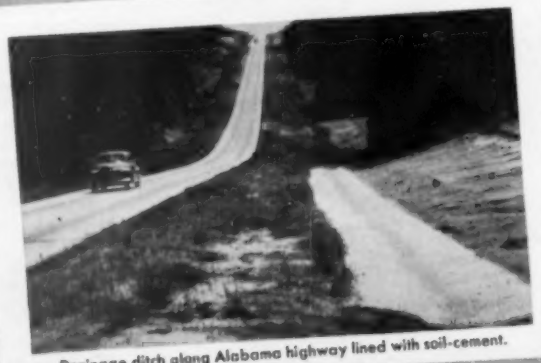
LeTourneau-Westinghouse Company
PEORIA, ILLINOIS
A Subsidiary of Westinghouse Air Brake Company

. . . for more details circle 213, page 16

In South Carolina soil-cement protects a bridge abutment.

Soil-cement stabilized bridge embankment and ditch in Tennessee.

Sides of highway cut in Texas paved with soil-cement.



Drainage ditch along Alabama highway lined with soil-cement.

Soil-cement paved highway berm and ditch in Texas.

Soil Erosion along Highways easily controlled with

SOIL-CEMENT

Paving highways at low cost with durable soil-cement is an old story in most states. Controlling ditch and backslope erosion with soil-cement is equally economical.

These photos demonstrate how soil-cement can be used for erosion control. They show two common methods of placement: (1) plastic soil-cement for narrow or steep slopes where materials must be mixed off the site; (2) compacted soil-cement for flat slopes where materials may be mixed in place. Either method produces excellent paving quickly and easily at low cost.

Soil-cement is economical for erosion control—as it is for all soil-cement projects—because about 85% of the material required is soil already on the site or nearby. And the construction equipment needed is the kind usually on hand in highway departments or available to local contractors.

Many soil-cement erosion control projects are in service throughout the country. For more information about low-cost control of erosion with soil-cement, write to address below, or to the nearest PCA district office.

PORTLAND CEMENT ASSOCIATION
Dept. A6-28, 33 W. Grand Ave., Chicago 10, Ill.

A national organization to improve and extend the uses of portland cement and concrete . . through scientific research and engineering field work

Fingertip controls are easy to learn, easy to operate. After handling Tournatractor for only 30 hours, a previously unskilled operator was doing a good job of final grading.

Rubber-tired tractor builds new streets *for old Baghdad*

Baghdad today is a city of great contrast. On one hand, you see ultra-modern apartment houses, gas stations, and soft-drink stands. On the other are ancient mosques and mud houses. Modern buses and automobiles mingle with throngs of camels and donkeys. Construction goes on everywhere. Even ancient narrow stone streets are giving way to broad, blacktop avenues.

A typical road-modernization project is now being handled in the Adhamia Subdivision of old Baghdad by United Contracting Company. Their rubber-tired Tournatractor has proved invaluable for building the sub-grades before final bitumen paving. This unit maneuvers easily in the narrow streets. Its big low-pressure tires absorb shocks when traveling on rough stone and earth roads — yet roll over newly-laid pavement and curbing without causing damage. Its 19 mph speeds permit fast travel between assignments — even enable the mobile Tournatractor to shuttle back and forth and handle assignments on two or more scattered projects at the same time.

More work, lower cost

Tournatractor has reduced contractor's equipment inventory and payroll, too! Owners estimate it would have taken at least four 45 hp crawler-tractors and one or two motor graders to handle the work done by this single 186 hp tractor-on-rubber. This is partly due to the superior working speeds and mobility of the rubber-tired unit; partly to the large amounts of material it handles on every pass; partly to the effective compaction of the rocky sub-grades by its big low-pressure tires.

United Contracting Company is finding many uses for this versatile machine. With the recent purchase of a double-drum power control unit, it can be used to operate a scraper or rooter, in addition to dozing and pushing. Thus, the company can now accept contracts for work that formerly had to be refused or sub-contracted.

Only one hour for repairs

When last checked, the Tournatractor had worked 1,967 hours on all types of jobs. Despite continuous operation in temperatures which varied from a high of 129° to a low of 35° (F.), it had been down only 1 hour of the 1,967 for repairs.

Ask for more information

Hundreds of progressive contractors all over the world are taking advantage of the ease of maintenance, speed, and high rates of production offered by Tournatractors. If you are interested in these same economies for your work, contact your LeTourneau-Westinghouse Distributor. He will be glad to give you complete information on these rubber-tired tractors.

Tournatractor dozes capacity 2½-yard load of silt, clayey loam, gravel, gumbo, and rock. Push distances range from 100′ to 1000′ depending on cut and fill required. Some material is drifted to both sides of the street to build up foundations for sidewalks. Low-pressure tires do not harm finished grades even after heavy rain.

Tournatractor—Trademark T-697-H-b

LeTourneau-Westinghouse Company

PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Co.

. . . for more details circle 214, page 16

LOAD..MOVE..and FILL at LOWER COST

with Firestone NYLON TIRES

FIRESTONE Nylon Off-The-Highway Tires are built to move more loads at lower cost. For any tough operation . . . earth moving, strip mining or rock work, Firestone has a nylon tire that will cut downtime and maintenance costs and keep men and equipment on the job.

It costs you less to run on Firestone Nylon Tires because the treads give maximum traction and they are extra tough to resist cutting. The sidewalls are double thick to give added protection against cuts and snags. The new Firestone Safety-Tensioned Gum-Dipped* nylon cord body gives the greatest protection against impact breaks . . . flex breaks . . . heat failures . . . and water damage.

Your Firestone Dealer or Store can show you how Firestone Nylon Tires will cut your tire costs.

*T.M. Reg. U.S. Pat. Off.

GROUND GRIP • ROCK GRIP • TRACTION ROCK • ALL NON-SKID • ALL TRACTION • RIB EXCAVATOR

When you buy new equipment or replacement tires, specify Firestone

Enjoy the Voice of Firestone on radio or television every Monday evening over ABC

. . . for more details circle 185, page 16

C. J. Langenfelder Co. of Baltimore, Md. is using all types of Euclid equipment to move 4½ million yards on the Northeast Extension of the Pennsylvania Turnpike. Here a "Euc" Scraper with Torqmatic Drive and 29.5 x 25.00 tires gets a heaped load of about 17 bank yds. for a half mile haul to the fill.

Euclid Availability Pays Off
on another tough job for Langenfelder

Men who know their earth moving equipment specify "Eucs" for their tough jobs. They know they can depend on Euclids to move more loads per hour at the lowest cost per ton or yard of material moved.

C. J. Langenfelder Co. is a good example. This well-known contractor has been a "Euc" owner for nearly 20 years and last year bought 52 more Euclids for highway and other earth moving jobs. For a 3-section contract on the Northeastern Extension of the Pennsylvania Turnpike, Langenfelder decided on 3 spreads of "Eucs" to move the bulk of 4½ million yards.

Four Euclid Scrapers of 15.5 yd. struck capacity and two Euclid Twin-Power Scrapers are moving 800,000 yds. on Section G . . . hauls average one-half mile with a maximum adverse grade of 10%. Bottom-Dumps of 13 and 17 yd. struck capacity and a fleet of 15 and 22-ton Rear-Dump "Eucs" are working on the other sections.

Langenfelder is standardizing on Euclids with Torqmatic Drive because of their production performance and low operating cost. In spite of tough working conditions caused by weather and the nature of the job, the Euclids are averaging better than 90% availability. Operating personnel say the "Eucs" are getting more work done than any other equipment they've ever used and maintenance costs per machine are lower than they've experienced on any job of this size.

"Eucs" are an important part of the profit picture for many contractors, large and small. It will pay you to get all the facts on the complete line from your Euclid dealer soon.

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

EUCLID THE PIONEER

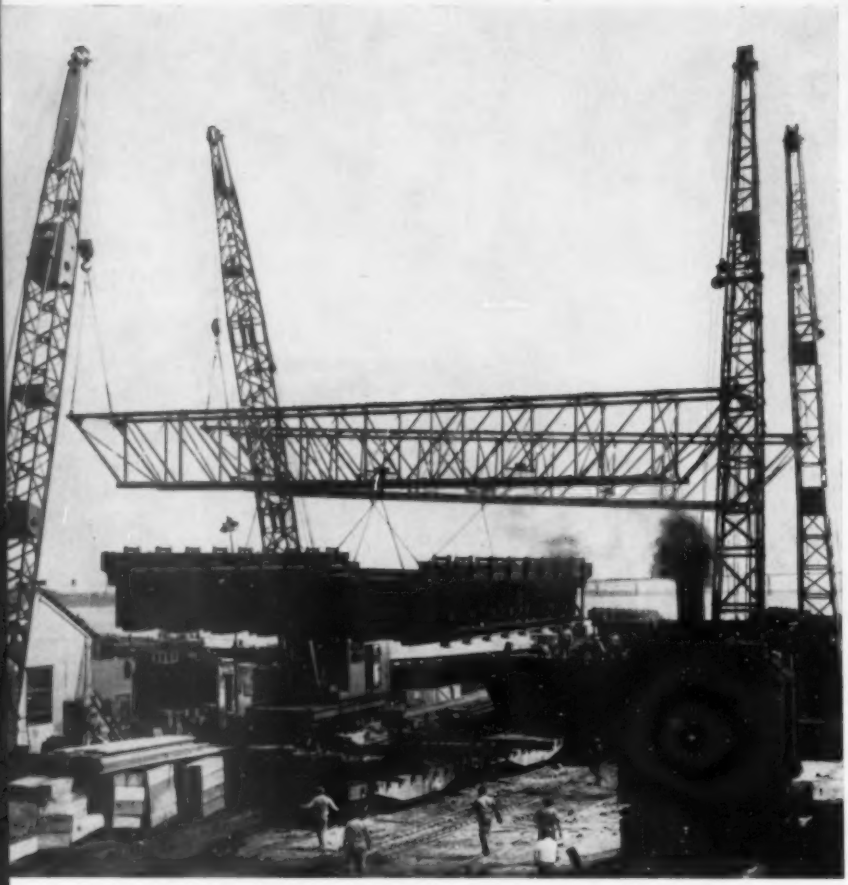
Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

GM GENERAL MOTORS

. . . for more details circle 192, page 16

Multiple-Use Forms for Causeway Deck Slabs



● Getting set for first concrete pours with 68-ton special forms.

CASTING of the concrete spans for the Greater New Orleans Expressway across Lake Pontchartrain will be expedited by 24 special forms.

Avondale Marine Ways, Inc., was awarded a subcontract for fabrication of the forms, which will constitute some of the most important project equipment. Fabrication is being done at Avondale's main yard below New Orleans on the Mississippi.

The forms, designed by the Louisiana Bridge Company, were modified by Avondale to suit their shop practice and to simplify fabrication. Due to the many moving parts, they were designed and built to tolerances extremely close for bridge work.

Each of the 24 forms will be used approximately 100 times. A precast section of concrete roadway, having an over-all width of 33′-0″ and a length of 56′-0″, and containing 91 cu. yd. of concrete will be removed from each form about every four days.

A major factor being speed, Avondale promised — and delivered — the heavy forms in 60 days. In order to meet this tight schedule, special dies and jigs were fabricated to speed their production. An assembly line of four jigs was constructed — each form remains in a jig for a period of seven days — and three of the forms delivered each week.

Since each unit weighs approximately 68 tons, transportation and delivery was a big job in itself. The forms were loaded on a barge from the firm's marine railway for delivery to the bridge site.

This causeway between New Orleans and Mandeville will be the world's longest vehicular bridge. The deck will be 28 ft. wide from curb to curb to be of precast, prestressed, pretensioned concrete construction on prestressed cylindrical piles.

Designed to provide a north-south crossing of Lake Pontchartrain, the bridge will shorten the route from New Orleans to the North. To provide for the passing of large craft there will be two double-leaf bascule bridges, and three humps in the profile will permit smaller boats to pass.

The Greater New Orleans Expressway was designed by Palmer & Baker of Mobile, Alabama. Contracts for the causeway and part of the approaches was awarded to the Louisiana Bridge Company, a joint venture of T. L. James and Company of Ruston, La., and Brown & Root, Inc., of Houston. Project manager is J. E. Walters with Jack Webber, engineer.

Bigger State Road Programs Assured

BY MANY NEW LAWS

NEW developments affecting highway-user taxation and the financing and construction of free highway and street systems, as reported from state capitals throughout the country, include the following:

COLORADO: Bills enacted by the Colorado legislature include a measure correcting legal defects in a $35 million highway bond program authorized by the voters last fall.

Under the legislation, originally enacted a year ago, not more than $8 million in anticipation warrants for highway construction can be sold in any one year. When the first issue will be sold and how it will be spent had not been indicated at this writing.

CONNECTICUT: A proposed state constitutional amendment to restrict highway-user tax receipts to highway construction and maintenance purposes was defeated by the Connecticut House of Representatives.

FLORIDA: Revision of state highway administrative procedures was proposed by a bill introduced in the Florida Legislature; an identical bill in the House. The 115-page proposal calls for a $15,000-a-year executive director who would replace the chairman of the State Road Board as the administrative operating head of the State Road Department.

Now paid $12,000 as a full-time administrative officer, the chairman would become a $6,000-a-year officer charged with coordinating the policies set by the board. The measure would provide staggered terms for the five board members, with two members always holding over. It would also set up a priority system for road improvements based on a sufficiency rating plan; would require that available federal aid funds must be matched up to 2 cents of the 4-cent gasoline tax; and would prohibit any road board from awarding contracts in excess of the ability to pay them off.

Another bill introduced in the Florida Legislature would transfer about $19 million a year in automobile license tag funds to the State Road Department.

GEORGIA: Plans of the Georgia Rural Roads Authority to let $10 million worth of road contracts for 118 counties by August or September were disclosed by George McDonald, state highway department engineer in charge of the rural program, in addressing a meeting in Atlanta of the Georgia County Commissioners Association.

Revealing that projects in 118 counties had been approved by the department, he said that as soon as the counties acquire rights of way and deed the roadways to the authority, bonds can be sold to provide the money.

The authority was set up by the 1955 Georgia legislature with power to issue up to $100 million in revenue bonds, to be paid off with a portion of funds which have been going to counties for road maintenance.

IOWA: A bill enacted boosted the state gasoline tax from 5 to 6 cents a gallon, to raise $7¼ million in additional annual revenue for primary roads.

Under the legislation, 2 cents of the tax rate is "temporary," scheduled to expire June 30, 1957. The fifth cent, voted for the first time two years ago, will continue paying solely for hard-surfacing primary roads that are now gravel-surfaced. Receipts from the sixth cent will be earmarked for "widening and modernization of highways and bridges" in the primary system.

Governor Hoegh, who favored the tax increase, said his goal is to "widen 1,000 miles of highway before the snow flies late in 1956."

Also enacted by the Iowa lawmakers was a measure designed to prohibit trucks from bringing into the state more than 20 gallons of gasoline on which the Iowa tax has not been paid. Penalties for violations would be up to $100 in fines or 30 days in jail.

MICHIGAN: A new bill to provide $35 million in additional annual highway construction revenue was passed by the Michigan Senate and sent to the House, where action was awaited at this writing.

It calls for increasing the state gasoline tax rate from 4½ to 6 cents a gallon and boosting the weight (license) tax on trucks an average of 10%.

The measure would give 75% of the additional revenue to the state for construction of 4-lane divided highways and split the remaining 25% between the counties and cities on a 2-to-1 basis respectively.

State and local units would be permitted by the bill to pledge part of their shares of the new money, within limitations, to finance bond issues for highway and street improvements.

The new measure replaced the so-called Peltz bill which was bottled up in a conference committee because of disagreement between the two legislative chambers over distribution of additional highway funds.

MINNESOTA: A proposed constitutional amendment revising the state's highway financing set up was approved by the legislature for submission to the electorate in 1956.

The amendment would change the present distribution of state-collected gasoline and motor vehicle tax revenues. Now totaling about $75 million a year, the revenues are currently distributed about 80% to the State Highway Department and about 20% to the county road and bridge fund.

The proposed amendment would distribute the revenues 62% to the state, 29% to the counties and 9% to municipalities over 5,000 population.

NEBRASKA: Pending are proposals to raise more than $2 million a year for highways, primarily from increased license fees on Nebraska trucks and a ton-mile tax on out-of-state trucks hauling 16 tons or more.

Also under consideration is a proposal to raise the state gasoline tax

Montana Diversion Amendments

A Montana Legislature has passed a constitutional amendment to dedicate highway tax revenues to highway purposes. It will go to the voters in the 1956 general election. Similar amendments are currently being considered in ten other states. Twenty-five states already have such constitutional protection.

from 6 to 7 cents a gallon during the travel season. The legislature earlier extended a temporary 1-cent gasoline tax until 1959, keeping the levy at its present 6-cent level.

OHIO: A bill proposing to substitute a special 2-cent truck gasoline tax for the state's controversial axle-mile tax against heavy trucks was killed.

Still awaiting Ohio legislative action was a bill to authorize state sinking fund commissioners to issue $216,372,000 worth of highway bonds, as part of the half-billion-dollar road bond program approved by the 1953 legislature and subsequently by the voters.

VERMONT: A bill backed by Governor Johnson to authorize a $12 million highway bond issue was approved by the Vermont Senate.

WISCONSIN: Legislation backed by Governor Kohler to add 2 cents to the state gasoline tax for an expanded highway program was passed by the Senate and sent to the House.

RHODE ISLAND: A measure to submit to Rhode Island voters a $30 million highway bond issue, to aid in financing a $70 million highway construction program over the next four years, was given final passage by the state legislature.

The bond issue, which would be the largest in the state's history, would increase the state debt by 75%. The state's net debt at the end of the fiscal year last June 30 was $42,585,510.

More Toll Road Developments

FLORIDA: An enabling bill for a state-long toll superhighway extending the projected Miami-Fort Pierce turnpike to the Jacksonville area, was passed by the Senate and returned to the House for concurrence in minor amendments before going to the governor for signature.

Only significant change made by the Senate was authorization for construction of a West Florida leg to Pensacola, if feasible.

The main turnpike is planned to tie in with the Miami-Fort Pierce "bobtail" pike and go through the center of the state, near Orlando, to Jacksonville. The extension of the bobtail pike is expected to require a $207 million revenue bond issue. The bobtail link, on which work has not yet begun, will take an additional $74 million bond issue, bringing the total cost to $281 million.

IOWA: A bill providing for the creation of a 5-member Iowa Toll Road Authority, empowered to finance and construct toll roads, was enacted by the state legislature. Initial project contemplated under the measure is a $180 million east-west pike from north of Davenport to Council Bluffs.

The bill was amended prior to final legislative approval, however, to stipulate that the Iowa toll road project cannot be started until a neighboring state "has negotiated the sale of revenue bonds to construct a toll road which shall extend to the boundary of Iowa." Illinois is considering such a turnpike.

Other amendments tacked onto bill:

- Provided a property tax comparable to that on similar facilities in the local taxing district for any restaurants, service stations and other establishments built by the authority and leased to private operators.
- Provided that a $75,000 appropriation to start the authority must come from State Highway Commission funds instead of the state general fund.
- Provided that turnpike revenue bonds held by Iowans shall be subject to state income taxes.

MICHIGAN: A bill to repeal the Michigan toll road enabling act was killed by the State Senate highways committee, which also blocked a proposal to give local communities veto power over the routes of proposed toll roads.

NEBRASKA: A bill to repeal a 1953 law creating the State Turnpike Authority was given initial approval in the Nebraska legislature, with a final vote still awaited at this writing.

OKLAHOMA: Under consideration in the legislature is a proposal to pledge revenues from the existing Turner Turnpike, running from Oklahoma City to Tulsa, as additional security for bonds of other proposed toll roads, including a contemplated new superhighway to the Texas line.

Under the plan, revenue from the Turner Turnpike, would be earmarked to help pay off other bond issues after the present turnpike indebtedness is retired.

The proposal was embodied in a committee substitute bill presented to the Oklahoma House roads and highways committee during its consideration of a bill for a new toll road from the Texas line near Gainesville to the Turner Turnpike.

Turner Turnpike revenues now are running far ahead of original expectations, and enough money is anticipated to pay off the bonds ahead of schedule. Under present law, the Turner Turnpike would become a free highway as soon as the bonds are paid off. But under the new proposal, tolls would continue to be collected until bonds on all turnpikes are retired.

PENNSYLVANIA: Two Senate enabling bills passed would clear the way for financing and construction of a new east-west extension of the Pennsylvania Turnpike system from Stroudsburg to Sharon and from the western part of the present turnpike to the West Virginia state line.

The proposed two new extensions would close the circuit of toll express highways within Pennsylvania and link the state's toll highways with a fifth other state when plans are complete.

The Pennsylvania Turnpike already links with the pike being constructed across northern Ohio and a bridge being built over the Delaware River will provide a connection with the New Jersey Turnpike. Previously-enacted legislation authorizes proposed links with New York State and Maryland. A northeastern extension from near Philadelphia to Scranton is under construction.

TEXAS: Plans were announced for a start in August on actual construction of the Dallas-Fort Worth toll highway if the Texas Supreme Court rules favorably on the proposed $58½ million revenue bond issue for the project.

Jack Davis, supervising field engineer for the Texas Turnpike Authority, said it was planned to advertise for bids on July 15, with the first contract to be let early in August if the bond issue is ruled valid by the court. The first contract will probably be for the Trinity River bridge in Dallas.

The pike will consist of a 6-lane divided highway, with 3 lanes in each direction separated by a median strip ranging from a 4-ft. wide raised section in urban areas to a 40-ft. wide strip in rural areas.

The blueprints call for only 3 major curves. Tentative completion date for the project has been set for April, 1957.

EXTRA **Mobile Equipment News** EXTR

VOL.2 — VICKERS INCORPORATED, DETROIT, MICHIGAN — NO.6

NEW—For Smaller Vehicles

VICKERS® HYDRAULIC POWER STEERING

LOW COST
Vickers Series S22 is a new, streamlined steering booster built especially for smaller vehicles. The design permits high production economies . . . and these economies are passed on to vehicle manufacturers.

SUPERIOR PERFORMANCE
The Series S22 has excellent operating characteristics . . . providing smooth, easy, fingertouch steering under all conditions. Obstructions, chuck holes, blown tires, etc. cannot spin the steering wheel or jerk it out of control on vehicles equipped with this Booster. Safer in traffic . . . on the farm . . . in the plant.

SIMPLIFIED DESIGN
Servo valve is simplified and smaller. Ease of servicing is another advantage.

EASY INSTALLATION
Oil connections can be placed in any one of four positions (90° apart) with respect to ball stud. This and the compact design make installation exceptionally easy and reduce its cost.

NEEDS LESS SPACE
Design is unusually compact and streamlined. Series S22 will go into a minimum space and usually requires little or no linkage change.

DEPENDABLE
All the "know-how" acquired in Vickers more than 25 years experience with hydraulic power steering has gone into the design and manufacture of the Series S22. Vickers hydraulic equipment of all kinds has a remarkable record of dependability. This booster is no exception.

ASK FOR NEW BULLETIN
A new bulletin gives more information on the Series S22 together with appropriate Vickers Pumps and typical circuit diagrams. Send for Bulletin M-5107.

For heavier steering applications and longer piston strokes, use Vickers Booster Series S23 (see Bulletin M-5106) or Model S6-315 (see Catalog No. M-5101).

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VICKERS SERIES VT16 VANE TYPE PUMP

This is the pump normally used with the Series S22 Booster. It has integral volume control and relief valve, and oil reservoir. The vane type design delivers more oil with less power. Automatic wear compensation and hydraulic balance contribute to much longer life with minimum maintenance. No-load starting is another advantage in cold weather.

7179

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

. . . for more details circle 245, page 16

ADVANCE BORINGS FOR SOILS DATA

How the highway departments are obtaining and utilizing better sub-surface soil and rock data for purposes of location, design, estimating and plans preparation

VI—Michigan's Procedure Helps Both Contractors and Design Engineers

By W. W. McLaughlin
Testing and Research Engineer, Michigan State Highway Department, Lansing

IT has been the practice of the highway department for many years to obtain, and make available to bidding contractors, a maximum amount of information describing subsurface conditions of soil and rock on construction projects. Although the cost of obtaining this information is borne by the department, the philosophy behind this practice is that (1) the department will thus secure reliable data available for design and planning purposes; (2) the contractor has perhaps more complete information than he would have under his own initiative; and (3) the cost will be offset by lower contract prices resulting from closer estimates of construction costs.

The information furnished or made available to prospective contractors is either placed directly on the construction plans or is in various reports which may be inspected at their convenience in the central office.

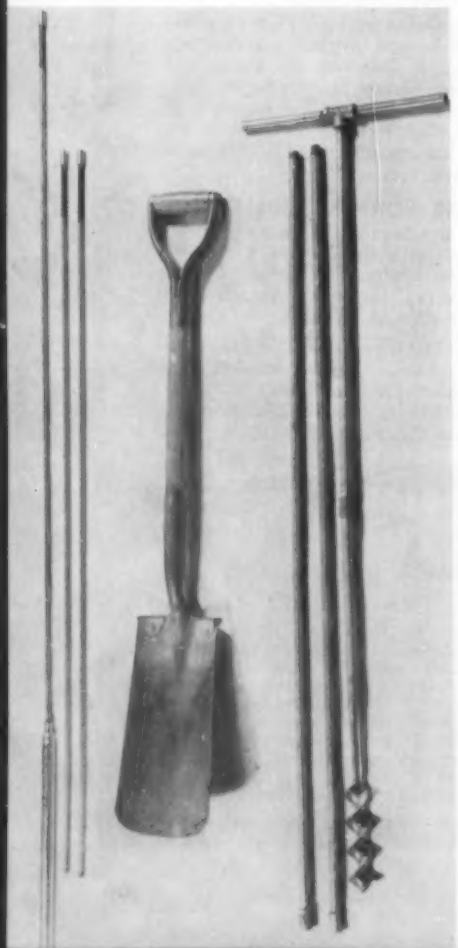
Subsurface information can be divided into seven classes as follows: (1) soil classification surveys; (2) rock soundings; (3) resistivity surveys; (4) hydraulic borings; (5) muck soundings; (6) continuous flight auger borings; and (7) laboratory test results.

Soil Surveys[1] — The first information obtained by the department regarding subsurface conditions on a proposed highway relocation is a soil survey of all the land within the right of way. The survey is made with a minimum of tools consisting mainly of a soils auger and tile spade. The completed survey is reported on a map showing the boundaries between the pedological soil types based on geologic origin, environment, drainage and relative position. This map also shows swamps, seepage zones, streams, and likely borrow areas. Several years ago a table was developed in which is given engineering data pertaining to each of the soil types encountered in Michigan. Since the soil classification map is transferred to the construction plans, the contractor needs only to refer to this table of soil descriptions and design recommendations contained in the MSHD Field Manual of Soil Engineering for the engineering data and aspects of any given soil type. For example, the design recommendations for an area mapped as Miami loam are as follows:

1. Ground surface relief is gently rolling clay uplands.
2. Not adapted to winter grading.
3. Normal water table is deep.
4. Grade line may be located anywhere.
5. Backslopes can be treated by topsoiling and seeding.
6. Estimated boulders or rock excavation is zero.
7. No stabilization treatment recommended of subgrade for flexible surfaces.
8. Topsoil should be removed for shallow grading.
9. Subbase is recommended.
10. Estimated 300 lin. ft. of frost heave excavation per 1,000 ft.
11. Estimated 400 lin. ft. of underdrain per 1,000 ft.
12. Suitable for borrow. (Embankment construction only.)
13. Shrinkage is 25-35%.
14. Embankment construction requires density control.
15. Is not a source of gravel.
16. Is source of good topsoil.

At the time soil surveys are prepared, recommendations are also made concerning the treatment for any unusual soil conditions encountered.

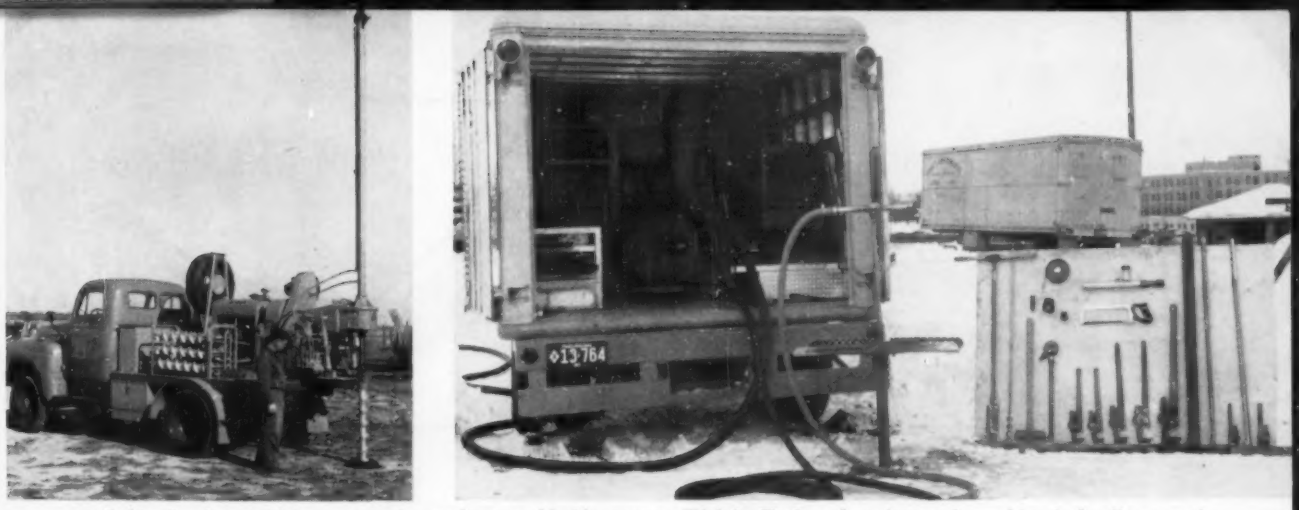
Resistivity Surveys[2] — Earth resistivity surveys are made in areas of heavy cut and in proposed borrow locations. Reports covering the results of these surveys are available for the contractor's review. Besides a detailed description of the subsurface condition regarding the general textural classifications of the soils, the report contains detailed longitudinal cross-sectional views of cut-sections showing the location of the boundaries between sand, gravel, clay, etc. From these cross-sectional views fairly accurate estimates of relative quantities of each textural class of soil can be made. This not only aids earthwork computation, but, perhaps even more important, furnishes information for scheduling earthwork operations. By reviewing the earth resistivity report together with the construction



● Soil survey tools used in Michigan include spade and soil auger, in center and right of photo, respectively. The Davis Peat Sampler (left) is used to make muck soundings.

[1] "Development and Application of Soil Engineering in Michigan;" O. L. Stokstad, Highway Research Bulletin 83, 1953.

[2] "Electrical Subsurface Exploration Simplified," H. E. Barnes; ROADS AND STREETS, May, 1954.



● (Left): Continuous flight auger boring equipment with 6-in. augers. (Right): Tools and equipment for making hydraulic or wash borings.

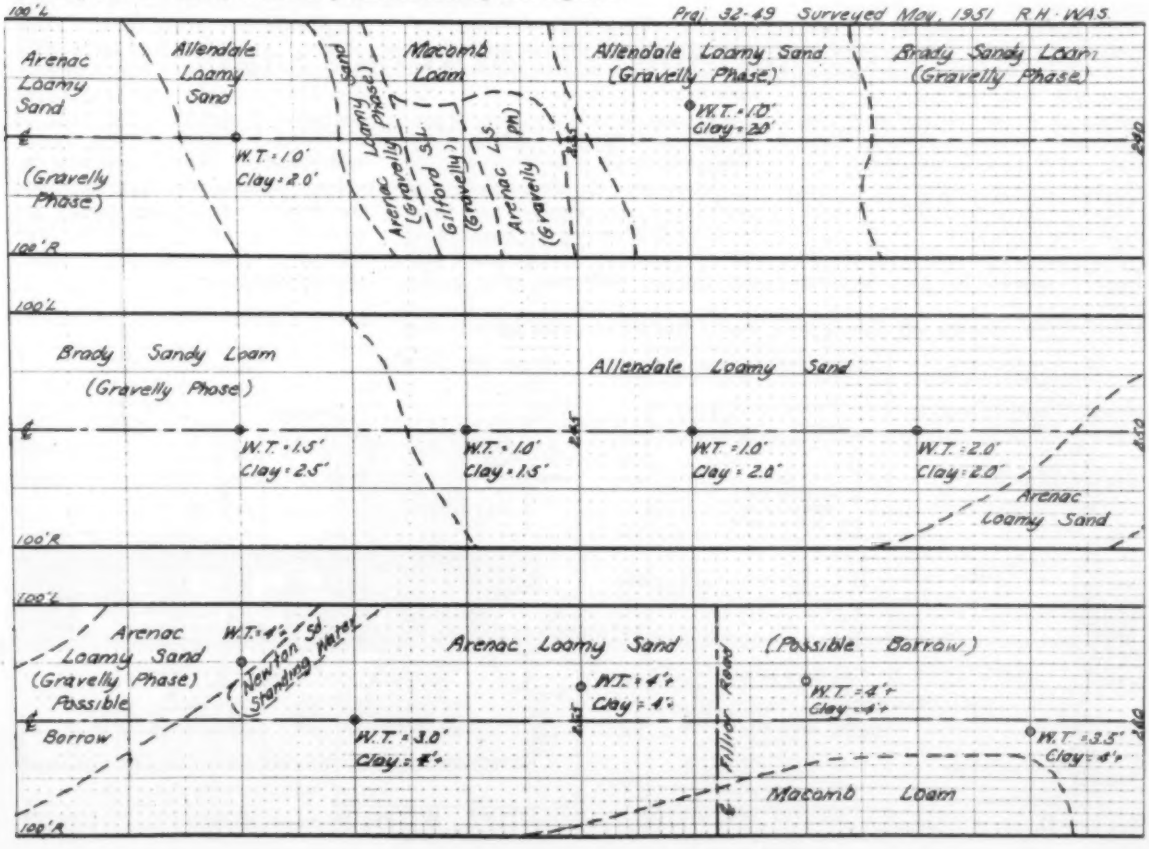
plans, the contractor has an inventory of materials by which he is able to program his work so that the granular areas may be reserved for winter construction. Furthermore, a knowledge of materials in heavy cut-sections will make it easier for selecting the most efficient equipment to perform the work.

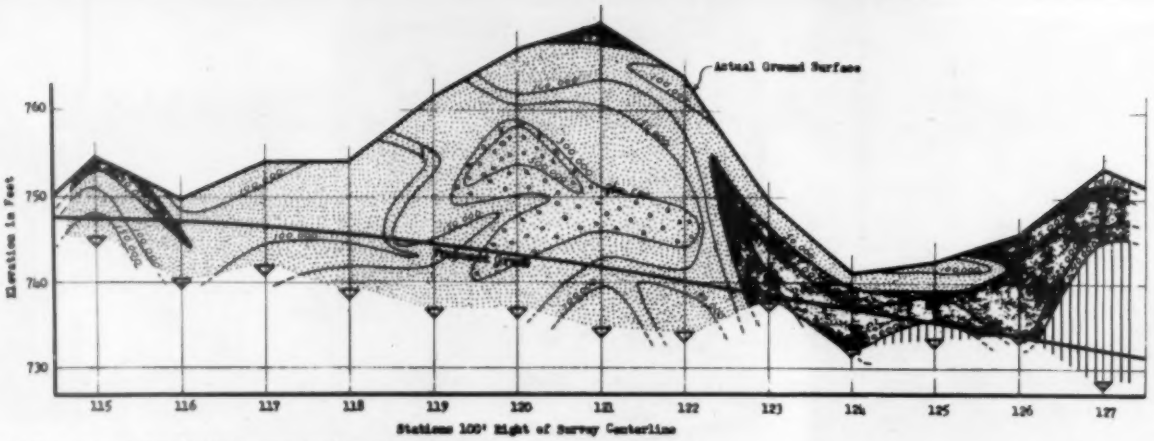
Muck soundings are generally made with the Davis Peat Sampler. By this means marls, peats and mucks are examined, classified and depths determined. This information, and the type of treatment required to correct the unstable areas, are noted on the construction plans. The contractor is therefore informed at the time of bidding regarding the location, extent, depth and type of muck to be encountered and the method of treatment he shall be expected to perform.

Rock soundings are usually made with steel sounding rods about 1-in. diameter and driven with a portable internal combustion hammer. The equipment is relatively light and may be taken into areas wholly inaccessible by wheel-mounted equipment. Soundings are made on centerline and right and left of centerline every 25 ft. along centerline where rock is encountered or expected within construction depth. Information thus obtained is transcribed to the plans, and the estimated quantities of rock excavation are placed on the construction plans and proposals. This information is very important to prospective contractors especially in selecting equipment and in scheduling operations.

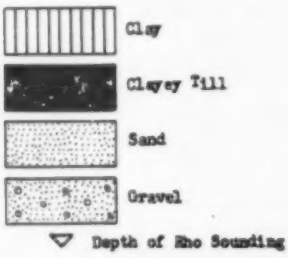
Hydraulic borings or wash borings are made for the purpose of obtaining foundation design information. A descriptive profile log of subsurface conditions is recorded, as both disturbed and undisturbed samples are obtained. These borings are made at sites for

● Example of soil survey section as plotted in field by soils engineer.





● Example of longitudinal cross-section taken from resistivity survey report.



proposed structures such as bridges, grade separations, and large culverts. Where clay or cohesive soils are encountered at sites of heavy construction, undisturbed samples of 1⅞ in. diameter are taken at depth intervals of 5 ft. These samples in turn are sent to a laboratory where the strength and general characteristics are determined.

The boring unit consists of a relatively high pressure pump and motor (275 psi), 1-in. hose, ¾-in. jetting pipes, 2-in. flush joint casing, sampling equipment, accessories, and tools. This equipment is contained in a large truck and is therefore completely mobile. Soundings in heavy clay soils to a depth of more than 100 ft. can be made in a single day.

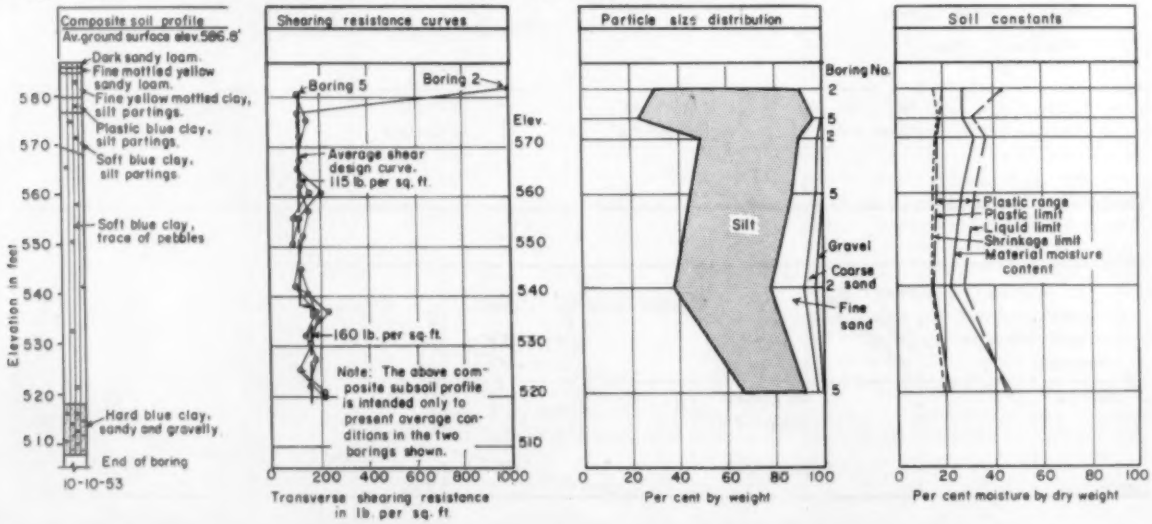
The boring logs and locations are shown on construction plans in order that the contractor may also have knowledge of subsurface conditions. This knowledge is especially valuable where deep excavations or pilings are involved.

In order to substantiate resistivity information and to obtain more concrete data regarding soil types in proposed borrow areas, the continuous-flight or spiral auger is used. A 3½ in. or 6 in. diameter auger is employed depending on the type of deposit being studied or the use to be made of the information obtained. The drill units are mounted on 4-wheel drive vehicles to obtain maximum mobility under difficult conditions. The spiral-auger unit is much more limited than the hydraulic unit but is less expensive to buy and to use. It is nevertheless a valuable tool for obtaining, correlating and substantiating data at depths up to 60 or 70 ft. where hand tools become impractical.

A number of tests are made in conjunction with the field exploratory investigation. Such tests as those made for determining the shear strength of undisturbed clay samples and those made for determining the gradation of selected materials from proposed borrow pits are performed prior to the project lettings. The shear strength values are used to decide whether spread footings or piles should be used for bridge structures, as well as for computing the size of footings or size and number of piles, whichever the case may be. These test results are also available to the contractor before bidding and may, therefore, influence his plan of operation and purchase of materials and equipment. A large amount of laboratory testing is done in connection with construction control after the contract awards have been made.

The seven items of subsurface investigations obtained at the expense of the department provide information available to the contractor as well as the department. This practice over many years has proved to be a sound philosophy as reflected in better quality construction, lower cost, and more expeditious contract performance. The confusion of working in the dark has all but been eliminated; the mutual understanding of the problems involved between the contractor and the department has been greatly improved. Disputes that inevitably arise from unclassified earthwork construction are avoided.

● Typical chart showing soil characteristics, shear values and composite log of borings.



Same equipment—different jobs

Should you change wire rope constructions?

Under normal conditions there is one best size and type of Red-Strand rope for every wire rope using machine. This is the one you use day in and day out on your routine work.

But what about other conditions, the tough job, the unusual job? Suppose abrasion becomes a bigger factor, or unusual strength is needed, or more flexibility? Is a change of rope type in order?

Take a power shovel, for example. Moving dirt, sand, gravel, ore, it works fast handling smooth loads. If it is on a long job of clearing large rock, however, it will move slower and receive heavy jars and shocks. A different Red-Strand wire rope construction will probably absorb shocks better and last much longer than ordinary types.

Take *your* equipment for another example. Whatever your business and however you use wire rope—if unusual conditions arise call in your Leschen technical man. Leschen makes all types, knows the special advantages and qualities of every one, and can help you choose the rope that will do your job best—on shovels or any type of equipment. Leschen's Hercules Red-Strand wire rope is working profitably in every industry.

Your Leschen man can easily be reached through your nearby Leschen distributor. See him soon.

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. . . for more details circle 249, page 16

The brand new LIMA type 24 Jobmaster

...a rugged specialist built with LIMA quality to fill your on-the-job requirements

Your on-the-job requirements are the key to design and construction of the brand new ½ yd. Lima Type 24. It's *your* machine, a rugged specialist built with traditional Lima emphasis on quality . . . to give you top performance without costly maintenance.

To fit it for every job within its class, the Type 24 is available with gasoline, diesel or electric power and can be equipped for operation as a shovel, crane, clamshell, dragline or pullshovel . . . crawler, wagon or truck mounted. With its air controls, all-welded construction and built-in stamina, the Lima 24 is from every angle the star performer in its class. Just check the list of Lima quality extras (at right); each one means greater operating benefits for *you*.

Put the new Type 24 to work for you now. It can build your operating profits everywhere you use it. Get complete details today from your nearby Lima distributor, or write to Construction Equipment Division, Baldwin-Lima-Hamilton Corporation, Lima, Ohio.

COMPARE QUALITY! No other machine gives you as much as Lima!

These quality extras are yours with the Type 24:

Rugged Construction for Low Maintenance

All-welded steel construction.
Splined shafting.
All gears have machine cut teeth.
47 anti-friction bearings.
Heat treated ground shafting.
Inside dipper handle—square cross section.
Safety glass throughout.
Dirt seals in tread rollers.

Top Performance

High speed independent boom hoist with engine controlled boom lowering.
Large diameter hoist, crowd, swing and propel brakes.
Large diameter hoist, crowd, swing and propel clutches.
Internal-external tooth jaw clutch for quick engagement, minimum backlash in gear train.
Independent combination chain and cable crowd and retract.
Independent propel (optional).
Independent third drum (optional).

Ease of Operation

Air for main and auxiliary controls.
Differential steering (similar to tractor).
Easily convertible to pullshovel, dragline, crane or shovel.

BRIEF SPECS—LIMA TYPE 24	SHOVEL	CRANE	DRAGLINE	PULL SHOVEL
Length of boom (standard)	16'6"	30'0"	30'0"	17'6"
Length of dipper handle	13'3"	---	---	6'0"
Overall length of crawlers				
—standard truck	10'2⅛" max.	10'2⅛" max.	10'2⅛" max.	10'2⅛" max.
—long & wide truck	11'9¼" max.	11'9¼" max.	11'9¼" max.	11'9¼" max.
Overall width of crawlers—				
Standard truck with 16" treads	8'0"	8'0"	8'0"	8'0"
Long & wide truck with 16" treads	9'4"	9'4"	9'4"	9'4"
24" and 30" treads optional on standard and long and wide truck				
Height of gantry above ground	9'8⅛"	9'8⅛"	9'8⅛"	9'8⅛"
Rear end clearance—maximum counterweight	8'11¼"	8'11¼"	8'11¼"	8'11¼"
Overall width of cab	7'10¾"	7'10¾"	7'10¾"	7'10¾"
Swing speed (R.P.M.)	4.2	4.2	4.2	4.2
Travel speed (high)	1.9	1.9	1.9	1.9
Capacity of fuel tank (gallons)	39	39	39	39
Approximate working weight	27,000	31,250 (with max. cwt.)	30,325 (with max. cwt.)	32,375

The Type 24 is a glutton for work . . . and Lima quality-construction enables it to travel and work anywhere at lowest operating cost.

Truck mounted for fast over-the-road travel, the Type 24 gives you maximum job mobility for extra production.

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CAPACITIES

LIMA Shovels, Cranes and Draglines are made in the following capacities:

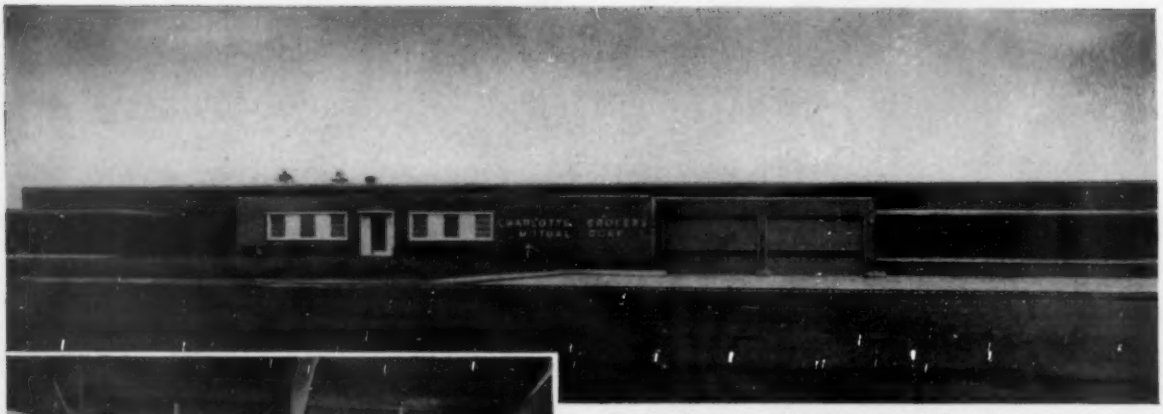
SHOVELS	CRANES
to 6 yards	to 110 tons
DRAGLINES	PULLSHOVELS

Smaller machines available on rubber.

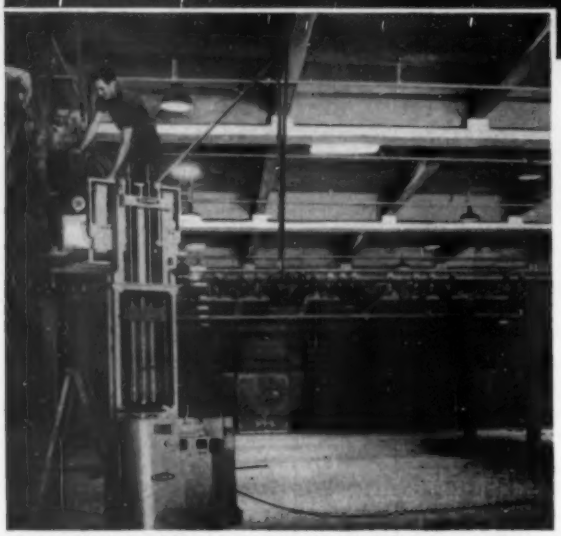
. . . for more details circle 165, page 16

ERECTED COST OF PRESTRESSED CONCRETE MEMBERS...

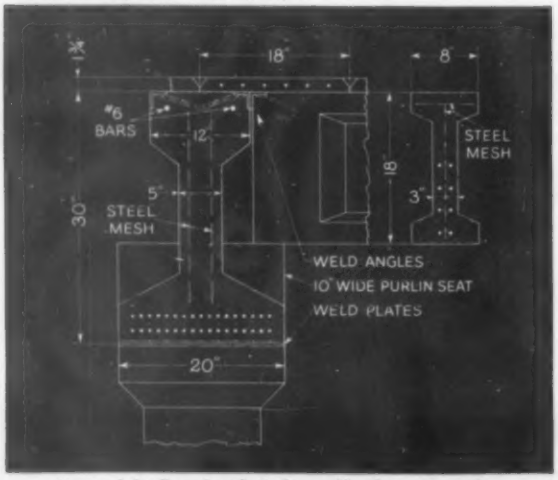
$1.10 PER SQ. FT.



Charlotte Grocers Mutual Warehouse. Area, 60,000 sq. ft. Prestressed concrete members made by Concrete Materials Inc.; Architect and Engineer, J. N. Pease and Co.; General Contractor, J. A. Jones Construction Co., all of Charlotte, N. C.



Specially designed for the material and method, lowest construction cost was achieved plus the fire resistance and durability that spell both minimum insurance and upkeep.



Structural details and method of assembly of precast members.

THAT'S THE GOOD NEWS about the new Charlotte Grocers Mutual Warehouse in Charlotte, N. C. . . . erected cost to the owner for precast columns plus precast prestressed girders, purlins and deck slabs was only $1.10 per sq. ft. And for the technically-minded, here are some of the data:

Live load—30 pounds per sq. ft.;
Tension elements—Roebling 7-wire stress relieved uncoated prestressed concrete strands;
30″ girders on 45′ span have thirty-four ¼″ strands;
18″ purlins on 24′ span have eight 5/16″ strands;
18″ x 1¾″ x 18′ deck slabs have six ¼″ strands and span 9′ c. to c. purlins;
Concrete—6000 psi ready-mix high-early;
Deck finish—grout joints between slabs.

Roebling engineers, leaders in the development of prestressing techniques and tensioning elements in America, will be glad to give you full information on tensioning materials and fabrication methods for this and other types of prestressed concrete structures. And they will always welcome the opportunity to cooperate with you to help assure maximum efficiency on any specific application of this economical and outstandingly modern structural material. Write Construction Materials Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

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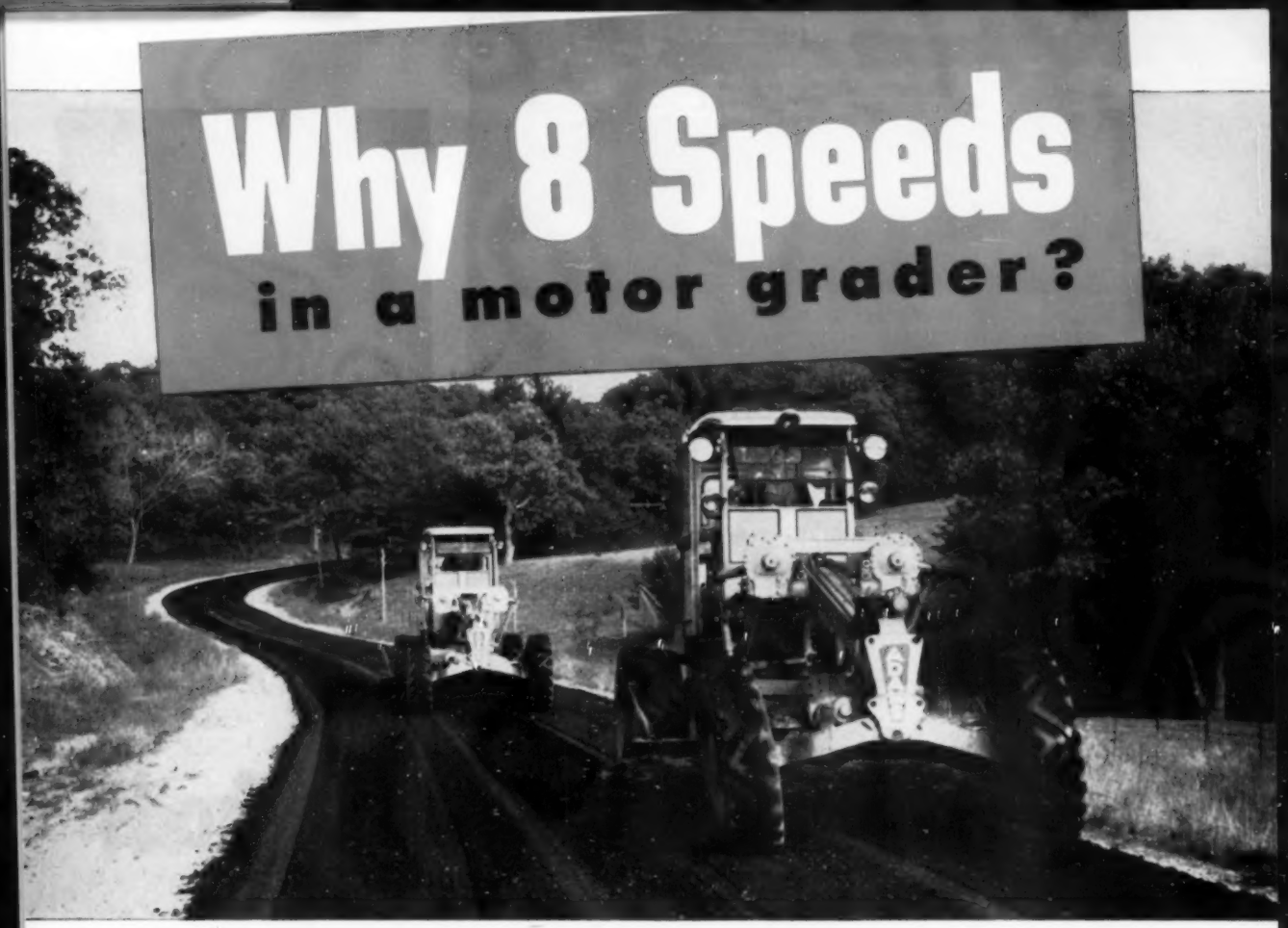

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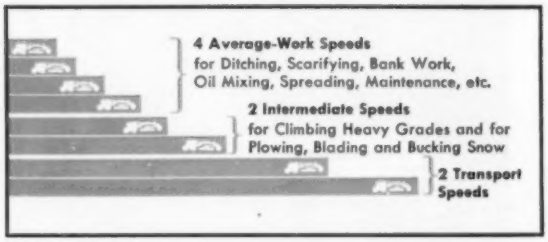
Other important advantages that make Adams Motor Graders your best buy include: 4 reverse speeds—optional creeper speeds (low as ¼ mph.)—easy-shifting, constant-mesh transmission—rubber-mounted engine—dual braking system . . . Available in 4 models, from 75 to 140 hp . . . Don't buy any motor grader until you investigate Adams—the most advanced line on the market. See your local Adams dealer or write



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Adams Motor Graders give you 2 more forward speeds than most graders—8 instead of 6. These additional speeds give you an extra working speed—4 instead of 3—and a higher "high"—up to 25 mph.—for getting to and from the job.

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Make your next motor grader an

ADAMS

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● Excavating last-remaining pockets of blasted material for expressway underpass, using Northwest truck crane and Mack truck. New sewer box seen alongside. Waterline suspended above the construction. (ROADS AND STREETS photo, March, 1955.)

● Temporary concrete footings, typical columns. Note grillage for riveting to underpass girders, and cleavage plane immediately below.

Fancy Underpinning Methods

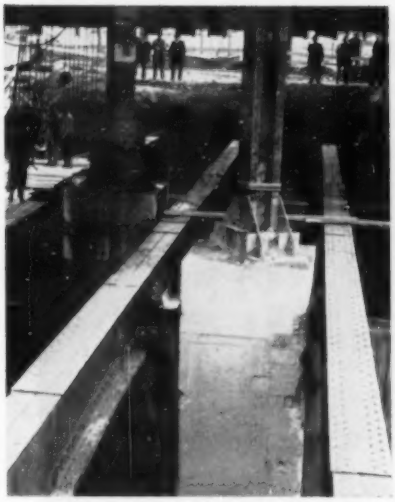
● Special design of temporary support, second stage. (Also see Fig. 2.)

Temporary column footings and special grillages were solution for cut-and-cover construction where Cross-Bronx Expressway line intersects with existing elevated railway viaduct and street traffic circle.

WHEN a modern metropolitan expressway plows beneath a busy street traffic circle, at the exact point where a subway transit viaduct crosses overhead, the contractors as well as the engineers have an interesting job on their hands.

This in a nutshell describes the problem encountered at Hugh Grant Circle in New York City, where the new Cross-Bronx Expressway passes beneath the junction of White Plains Road and Westchester Ave. The location problem was further complicated by the need to excavate solid rock under and around a station building, a trunk sewer and various building foundations.

The job is part of a 1.3-mile contract section of the expressway awarded to Slattery Contracting Co., of Maspeth, L. I. The cut-and-cover rigid-



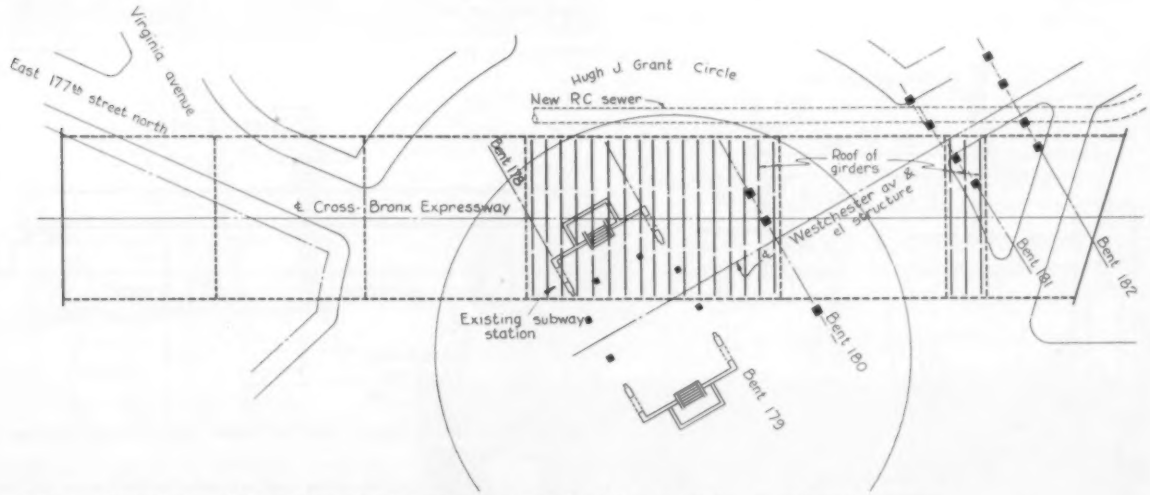
● Same columns as seen at left on opposite page, after girders set and grillage ready for riveting. See also detailed sketches.

● Looking through excavation with No. 180 columns in foreground, camera being pointed along centerline of expressway underpass structure, with elevated railway station seen in background.

for Expressway Junction

framed tunnel construction at this junction is perhaps the most interesting feature of the $7,000,000 project, which also involves the usual assortment of street overpasses, ramps and retaining walls as well as grading, drainage, paving, landscaping work and lighting.

The general situation at this 3-level junction is shown in Figure 1. The first requirement was to maintain normal transit operation including use of the station building at all times, which meant that the viaduct superstructure was not to be disturbed. The traffic circle was closed to vehicular traffic on one side, and traffic maintained through the area by a temporary bridge permitting use of one side of the circle, the closed-off paving being taken out in the early stages of the work. The traffic circle will be restored with some modernization on completion of the underpass.



● Fig. 1. General plan of the project, showing columns of transit viaduct in relation to underpass structure.

● Excavation in progress immediately under the viaduct, using a Northwest truck crane and Mack and Autocar 10-wheelers.

The underpass consists of a reinforced concrete twin rigid-frame tunnel about 640 ft. long, providing for two 3-lane roadways. The central part of the structure which will support a surface-level roadway and several viaduct columns will have steel roof girders encased in concrete. The remainder is of standard reinforced concrete rigid-framed construction. The middle and outer tunnel walls are founded on bedrock.

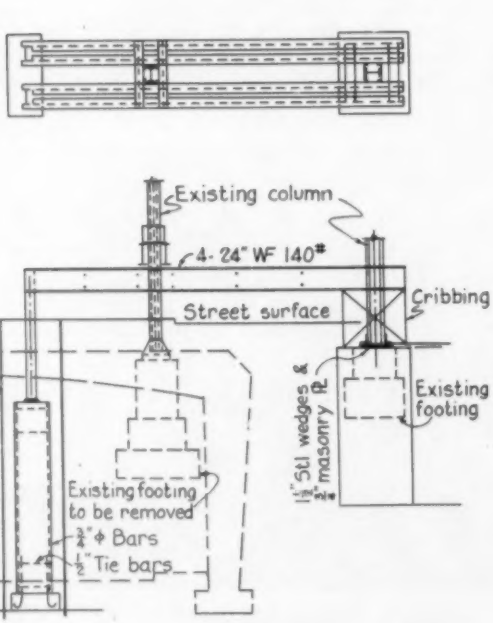
A total of 19 viaduct columns required temporary support during the underpass construction. Live and dead load concentration on the columns range up to a maximum of about 700,000 lb. The procedure for maintaining column support during construction and of re-establishing permanent support was as follows:

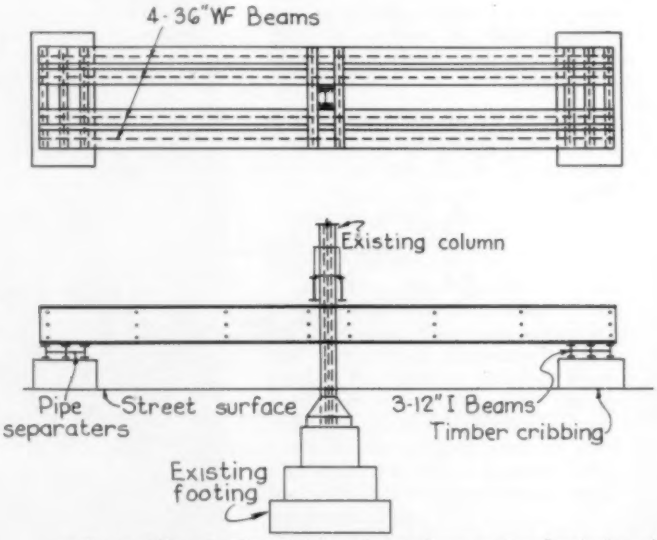
1. When rock excavation was begun, provision for temporary column support was made by riveting vertical I-beam brackets to the columns. (See lower photo, p. 72.)

2. Under these brackets a pair of 18-in. I-beams was placed horizontally and in turn rested on 36-in. needle beams on temporary footings. These offset footings in some instances consisted of concrete sills at or near the original ground level in most cases, however, they consisted of steel or timber grillages but in some cases, of reinforced concrete columns. The supports extending to various excavation depth as necessary.

3. The viaduct column was then lifted a fraction of an inch with hydraulic jacks under the needle beams, the existing footing removed, and the area immediately around the column excavated to full depth.

4. A temporary reinforced concrete column extension was built directly beneath the viaduct column, this support being carried full excavation





● Fig. 2. (Above): Typical first and second stages of underpinning of viaduct columns.

● Fig. 3. (Left): Special offset underpinning, second stage, for one column (see also photo on first page of this article.)

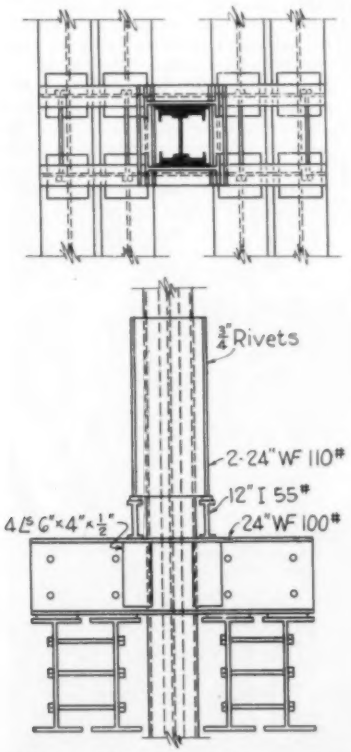
● Four Homelite vibrating units powered spud vibrators for use during the 1,000-yd. underpass pour.

depth or 28 to 30 ft. below the original column footings.

5. The needle beams and grillages were then relieved of their load, and the beam brackets eventually burned away.

Permanent Load Transfer

6. Embedded in each concrete extension at the proper elevation was a steel grillage complete with rivet holes, designed to effect permanent



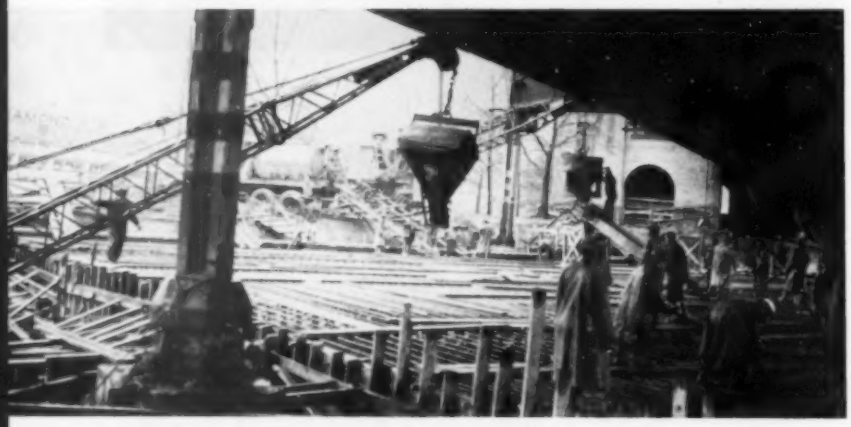
● Fig. 4. Details of temporary support for some of columns in bents 180 and 181. (see also the photos).

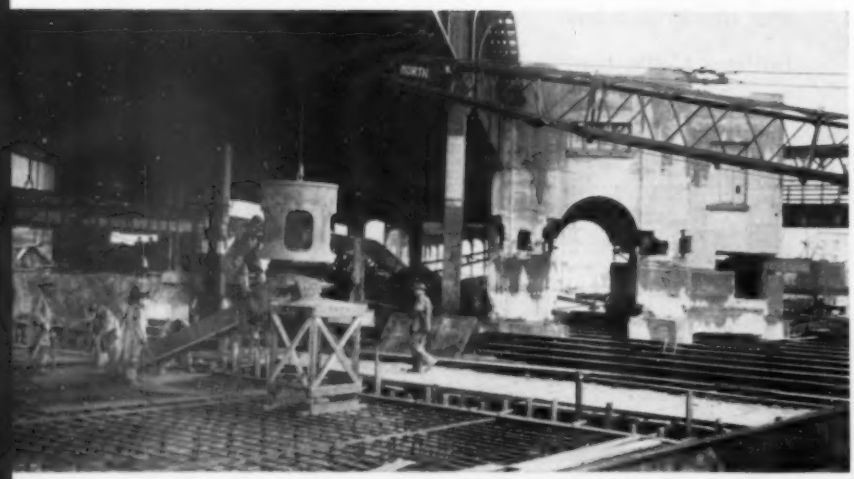
● Forms about ready and reinforcing steel going in for 100-ft. double-rigid frame underpass pour. Remaining roof forms will be set by truck crane after pouring quick-setting concrete footers for form support.

Underpass Job — *Continued*

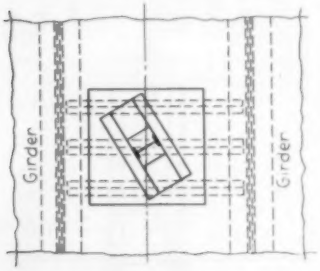
load transfer from the column to the underpass roof structure. (Figures 5 and 6). The usual pattern was for a post to fall between two girders, with grillage connections. A double or box-girder was required at one point to carry an unusually heavy beam concentration.

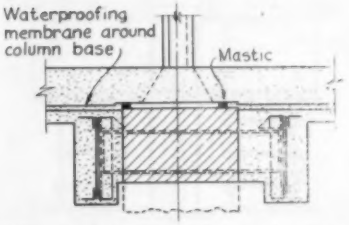
7. On completion of the roof struc-





● (Left across and below and right): Three truck cranes (Lorains and Northwest) were used to make the 1,000 cu. yd. underpass pour, one being stationed at lower level. Direct chuting also resorted to, so that five of Transit Mix Corporation's 8-yd. Rex mixers were delivering at any one time. Pour began at 6:30 A.M. and completed in single day, despite necessity of raising and lowering crane booms for each bucket load due to lack of headroom.





● Fig. 5 and 6. Typical details of grillage encasement used when existing column load is transferred to roof girders.

ture the lower part of the column was knocked out, to clear the way for construction of the expressway paving. Removal was facilitated by a cleavage plane. In the first columns poured, this plane was provided by use of a layer of tar paper, after which a construction joint was considered to suffice.

Seven viaduct columns located immediately adjacent to a large trunk sewer, but offside from the underpass, were underpinned with needle beams; the old shallow footings were removed and new footings were carried down to the sewer foundation elevation.

A procedure similar to the above was used to underpin the footings of the station building, whose foundation walls were cut away as required to expose column steel for riveting on needle beam brackets and footing grillages. Most of the building's columns are supported on the underpass girders or walls.

● The station house. No, not after a bombing raid, but after the building was underpinned and most of the excavation completed. Note steel grillage bracket connections for transferring support from removable temporary undercolumns to the underpass wall or to roof girders.

The mica-schist at this site was excavated with wagon drills and jack hammers, powered by a compressor station consisting of two 600 and four 500 cfm compressors (Chicago Pneumatics and Gardner-Denvers). Up to ten wagon drills were massed on the work, so the excavation could progress rapidly despite constant interruptions. As described in a previous article (Case 9 in "Blasting Methods in Roadbuilding," ROADS AND STREETS, May, 1955) blasting had to be done in very close quarters, requiring utmost skill and judgment. Individual shots seldom exceeded four or five

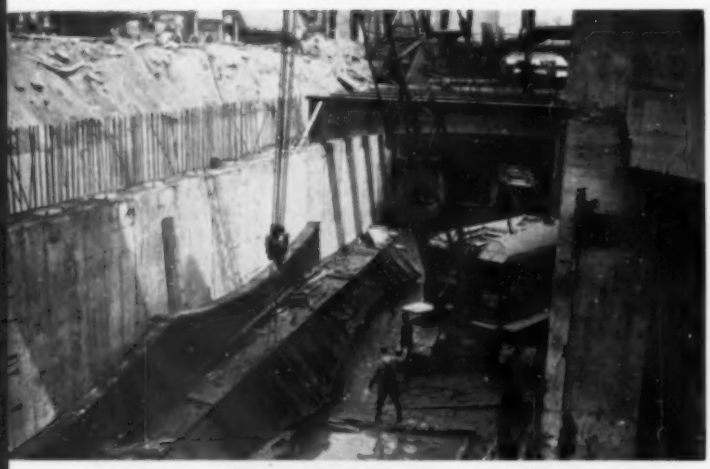
● Heavy reinforcing steel about ready for pouring the double rigid-frame tunnel. Note ceiling light units in the boxes, set in position.

1 Just arrived. A pair of 95-ft. roof girders for special section of expressway underpass.

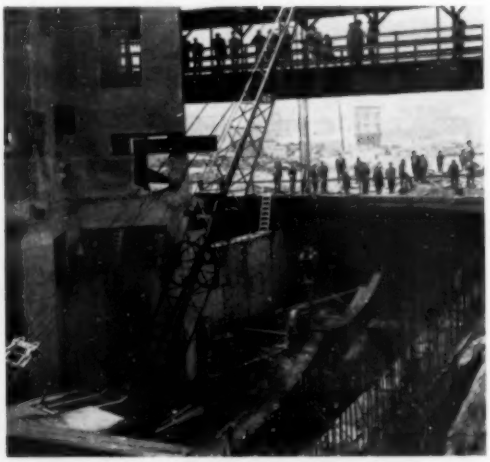
2 Crane has set girders off the trailer onto timbers. Now to turn the critters over for setting.

Step-by-Step: Setting Girder in Tight Spot

(Continuation of Cross-Bronx expressway job summary from pages immediately preceding)



3 Over on its side, then take a fresh hitch for hoisting. Six men including operator on hand.



4 Camera moves to other side as the girder starts to raise. The sidewalk superintendents are legally out-of-bounds, by the way.

5 Up she comes, and is being turned by a guide rope as the crane operator raises his boom angle.

6 The girder comes to rest on its steel shoe plates — a perfect fit. Center wall of underpass seen under the sling. Elapsed time, one hour, and try and beat it!

holes, and often only two or three holes were shot at a time, using millisecond delay caps. In all cases heavy blankets woven with ¾ in. wire rope were employed.

1,000-Yd. Pours

An interesting job feature was the forming and pouring of the underpass tunnel. Forms for the heavy reinforced concrete twin rigid frames were erected in panels about 100 ft. in length, supported on concrete sills. At the south end the forms were so wedged up that they could be lowered after a pour, coming to rest on lines of steel pipes. These served as skids while the contractor drew the heavy panels forward with truck-mounted winches.

The heavy cross-section required about 1,000 cu. yd. of concrete per 100 lin. ft. Two pours of about 1,000 cu. yd. were each made in a single day using up to 25 transit-mix trucks, and three or more truck-cranes with drop buckets plus direct-to-chute delivery. Placement was hampered during the pour immediately under the viaduct (see photos) due to lack of headroom for crane operation. Concrete was provided by the Transit Mix Concrete Corporation, of N. Y.

The Cross-Bronx Expressway project of which the above-described operation was a part is a Federal-Aid project being built by the New York State Department of Public Works, under the Babylon district office; John W. Johnson, Superintendent of Public Works, and Milton Goul, district engineer, with Harry Simberg as field representative. The work is part of the expressway and parkway program of New York City, under City Coordinator Robert Moses. The firms of Andrews, Clark & Buckley and Hardesty & Hanover are serving as designing and supervising engineers, with James Carroll, resident engineer. Slattery Construction Co. is represented on the job by Al Korson, chief engineer, Jerome White, resident engineer, and Patrick Kelly, superintendent.

Thruway traffic rises sharply

Indicating the sharp seasonal rise in motor vehicle transportation in upstate New York, as well as a growing patronage of the new thruway from Buffalo eastward, commercial revenue climbed 28.1% higher in March than in February, with commercial trips up 22%. Truck revenues have increased each month since the first toll section of the expressway was opened last June 24.

● Portable mixing plant erected by D. W. Winkelman Co. in 1954 for Ohio Turnpike project. Deming vertical turbine pumps were installed here to supply 40,000 gal. of well water needed daily for paving operations.

Winkelman drilled deep for concrete mix water

Superhighway construction continues to challenge the ingenuity of road builders in many states. Illustrative of this is the water supply problem confronting contractors in the paving of the Ohio Turnpike, the eastern section of which was opened to traffic in December, 1954.

Like most turnpikes, the Ohio thoroughfare by-passes major cities and heavily populated areas. This makes it impractical to obtain water from any municipal system.

Two wells, one 275 feet deep, were drilled at a portable mixing plant erected by D. W. Winkelman Co. near the center of the pike's Eastgate section. Deming vertical turbine pumps were installed to supply the 40,000 gallons needed daily during the four months' paving operation.

The well supply dwindled, however, and had to be supplemented by trailer-drawn water. More than seven million gallons of water were used in paving the ten-mile section contracted by the Syracuse firm.

Radio equipment for Indiana toll road

Five companies submitted bids on communication equipment for the Northern Indiana East-West toll road. General Electric Company, the lowest of the bidders, was awarded the contract by the Indiana Toll Road Commission. It provides for outright purchase of the equipment by the Commission and also for a monthly maintenance fee of $4,791 for a five-year period.

The communications facilities will provide a combination micro-wave and VHF radio system with installation in approximately 65 toll road vehicles, including police cars and maintenance trucks.

Bids on Radio Facilities for Indiana Toll Road

	Purchase Price	Lease	
		Monthly Maintenance	Monthly Rental	Monthly Maintenance
General Electric	$444,371.00	$4,791.00	$ 8,652.70	$4,791.60
Motorola	767,811.00	5,615.10	14,588.41	5,615.10
Federal Telephone & Radio	734,992.73	7,442.61	15,435.85	7,442.61
Radio Corporation of America	710,340.00	5,668.31	15,420.65	5,668.31

Bids from the five companies included both a purchase and a lease basis and covered two types of systems. (Bids covering the micro-wave and VHF radio equipment are shown in the accompanying table.)

Indiana Bell Telephone Company submitted the only bid for a lease of the combination telephone and VHF system, being considered as an alternate. Their bid was $10,376 monthly rental and one-cent monthly maintenance. Bell offered an alternate bid for installing a modified telephone and VHF system at a total monthly charge of $6,974. This bid, however, did not conform to specifications.

Contractor association tours students over jobs

In order to arouse the interest of future engineers in heavy and highway construction, the Constructors Association of Western Pennsylvania arranged a tour of construction projects in the area for the Carnegie Tech student chapter of the American Society of Civil Engineers. Over 60 students, sophomores, juniors and seniors, visited three projects now under way in the Pittsburgh district.

The group first visited the job on the piers for the new Fort Pitt Bridge under construction by the John F. Casey Company of Pittsburgh. They then left for the Navarro Corporation job on the foundation for the new State Office Building on the Boulevard of the Allies and finally, they were shown the Eichleay Corporation's job of replacing the Pennsylvania Railroad Bridge over the B & O tracks near the old B & O freight terminal.

The group was broken into smaller groups of 10 to 15 men on each project and company representatives discussed methods of construction and answered questions. A program is being organized whereby student chapters from other cities will make exchange visits with local colleges.

Pavement marking with plasticized sulfur

Experiments with plasticized sulfur compositions for traffic markings are producing encouraging results according to reports from Texas Engineering Experiment Station, College Station, Texas.

"Optimum results are obtained with a sulfur composition containing 5 to 15% of Thiokol Type A, 1 to 3% of a Hansa Yellow type pigment, and 0.5% of a suitable bactericide. The incorporation of glass beads results in fairly good light reflectance and increases the effective life of the material. The results of recent tests, which will require longer observation, indicate that the incorporation of about 2% of wood rosin is significantly beneficial."

Full details are contained in the article "Plasticized Sulfur Compositions for Traffic Marking" by C. Kinney Hancock which appeared in the November 1954, issue of *Industrial and Engineering Chemistry* and is available from the Station as Reprint No. 37.

● An association-sponsored student tour.

GARDEN STATE PARKWAY, New Jersey's contribution to the superhighway system in the East, is rapidly nearing completion, with most of its 164 miles already open for travel. One of the contractors working on the last leg of this road is Public Constructors, Inc., of Pleasantville, New York. Two of their AD-40 motor graders are maintaining haul roads from borrow pits as well as roadbeds for Allis-Chalmers Motor Scrapers during fill operations. High-arch front axle, ROLL-AWAY moldboard and ample throat clearance allow these big graders to handle 30 percent bigger loads without disturbing the free, rolling movement of material.

ROLL-AWAY is an Allis-Chalmers trademark.

THE TURNER TURNPIKE saves travelers almost an hour on its 88-mile stretch between Oklahoma City and Tulsa, Oklahoma. Maximum grades of 3 percent, 200 to 400-ft right-of-ways, 12-ft paved shoulders and long sweeping curves make the drive easier and safer, too. Contractor M. E. Gillioz, Monette, Missouri, added an AD-40 to his other Allis-Chalmers equipment when he was awarded contracts for clearing grading, and culvert work on the new road. Now, he and his operators know firsthand why the AD-40 gets so much work done so quickly. Tough, rugged construction with tubular, single-member frame and clear, unobstructed visibility that helped operators see more and do more helped Gillioz decide to make the AD-40 grader a regular member of his spread.

THE KENTUCKY TOLL ROAD will be a four-lane divided highway with two 12-ft strips running in each direction for the 40 miles between Louisville and Elizabethtown. Four-foot surfaced inner shoulders and ten-foot surfaced outer shoulders will add to the many safety features of the new road which also includes vertical separation of all intersecting highways and railroads. Traylor Brothers Contracting Company of Evansville, Indiana, is operating six AD-40 motor graders, maintaining haul roads and leveling fill on their contract for this new road. This grader's powerful engine and its ROLL-AWAY moldboard team up for top production shift after shift, day after day, year after year.

ALLIS-CHALMERS HEAVY-DUTY AD-40 MOTOR GRADERS...

Set the Standards on the Turnpikes

From the construction of superhighways to the maintenance of farm-to-market roads . . . wherever motor grader performance and dependability count, you'll find Allis-Chalmers AD-40's in the thick of the action. It will pay you to consider putting the job-proved AD-40 grader in your spread, too . . . see your Allis-Chalmers dealer.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

THE SCHUYLKILL EXPRESSWAY will link with the eastern section of the Pennsylvania Turnpike by bridge across the Delaware River in South Philadelphia. Conduit and Foundation Corp., of Philadelphia, is working on part of this job for the Pennsylvania Highway and Bridge Authority and is using two Allis-Chalmers AD-40 Motor Graders in their spread. The machine shown here is working between forms, grading the base course before a strip of 10-in. reinforced concrete surface pavement is laid. The AD-40's mechanical blade control linkage gives the operator the "feel" of the work on a job like this. Tandem drive traction and shock-absorbing frame add to stability, help prevent blade chatter on precision grading.

. . . for more details circle 163, page 16

Job and Equipment Ideas

● Truck mounted power unit (a GM 278-hp twin diesel) drives the hammermill of this portable crushing plant.

Truck-Mounted Crusher Engine

. . . saves money in portable all-diesel aggregate plant

Diesel engines recently installed on portable rock crushing equipment are said to have cut costs and reduced engine downtime in the quarrying operations of the Killough Construction Company of Ottawa, Kansas. The company owns one crusher and circulates it between six leased quarry sites in eastern Kansas.

Robert Killough, company president, reported that dieselization of his equipment was completed in July, 1954, with the repowering of a ¾-yd. Northwest shovel. The new engine, a General Motors Series 71 Diesel, replaced a gasoline engine and reportedly increased the shovel's work capacity 25 per cent while its operating costs were cut one third. Using the same type of power on each piece of equipment in the operation has made servicing easier and allowed standardization on a smaller number of engine parts.

Other equipment in use includes a Cedarapids hammermill with a GM 4-71 engine operating conveyors and screens, and a Twin 6-71 mounted on a small truck operating the mill itself. A Cedarapids 22-in. x 36-in. primary crusher is driven by a GM 6-71 while another shovel — a GM-powered ¾-yd. — completes the crushing and handling equipment. The plant, recently operating near Ottawa, turned out 125 tons of stone per hour.

Service truck has long hoist rail

Overhead hoist rails mounted on frames of service trucks are not uncommon these days, but it isn't often that you see one like the rig pictured.

This is a Ford truck equipped by Guy F. Atkinson Company of South San Francisco, California, for use in connection with the big over-water fill on the Bayshore Freeway south of San Francisco. (Described in January, 1955, ROADS AND STREETS.)

The rail mounted on three frames, hangs out in front as well as in back of the truck, so that a pick-up job can be done from either end. In addition to a power horse unit and a chain hoist, this rig also carries a light plant and acetylene welding equipment.

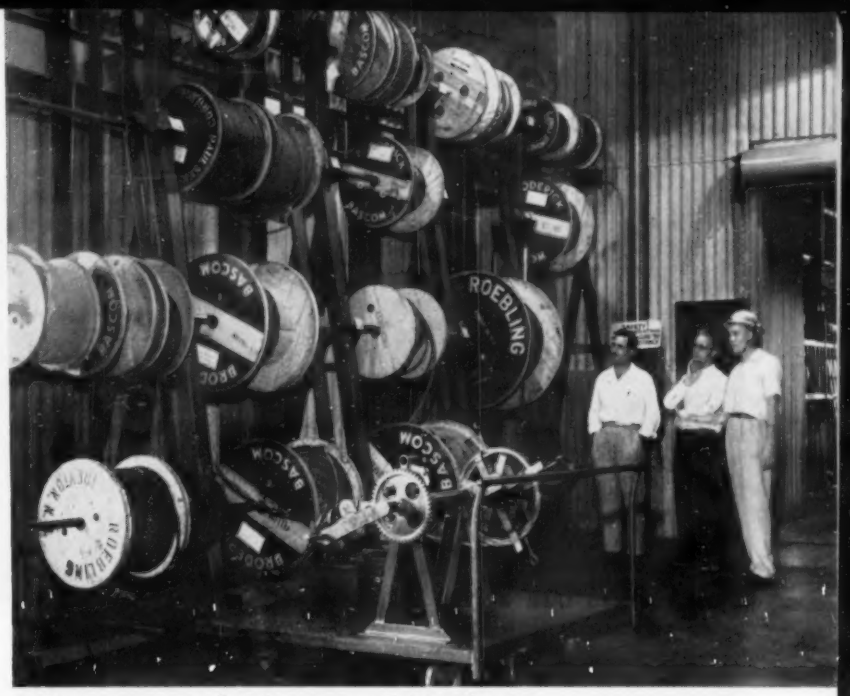
● Long hoist rail enables this truck to do a pick-up job from either front or rear.

Clean, efficient storage for wire rope

Much has been said about the value of properly storing and handling wire rope. Many contractors today mount the reels of rope on spindles in their garages or shops, so that rope can be dispensed as needed without contact with dirt or moisture.

A deluxe job of rope storage of this kind is pictured here, courtesy John E. Davis, editor of *"Shell Progress"* published by Shell Oil Co. This stock of rope is in the wholesale warehouse which Shell maintains in connection with its largest U. S. refinery at Wood River, Ill., near St. Louis.

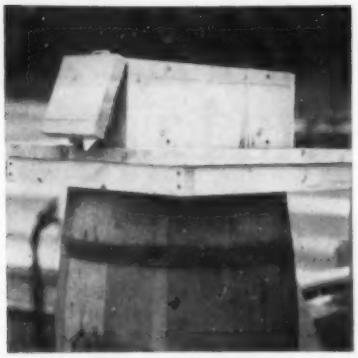
The device on the dolly-mounted platform is for measuring and cutting rope as it is needed.



● Wire rope storage and cutting system at Shell warehouse.

Handy cup dispenser

A cool water barrel, a wood platform placed on top, and a white pine box with gravity hinged end (a la rural mail box) for paper cups — that's the popular drinking water dispenser arrangement seen on the job of V. N. Holderman & Sons, Inc., on the Ohio Turnpike. The little box is shown here with a cup partially out, ready to be snatched and used on a hot afternoon.



● Looks like a glorified mouse trap, but it's a drinking cup dispensing box — keeps cups shielded from dust and heat.

Heavier cabs on earthmoving rigs

(From "Safety Bulletin," Office of the Chief of Engineers, Safety Division, Corps of Engineers; Report for the First Quarter, 1954.)

"Euclids and similar types of earthmoving equipment at Garrison Dam have 'That New Look' in comparison with equipment on other projects. During the past years there have been quite a number of operators of this type of equipment killed when their vehicles jackknifed or upset. (Stick around, we'll get to the point.)

"It was impossible to determine in most instances whether the operator had jumped or had been thrown off the machine since they were usually killed by the machine running over or the trailer falling on them. The project manager for our Main Embankment, PK-MK Co., decided not to have such accidents on this project. And he hasn't.

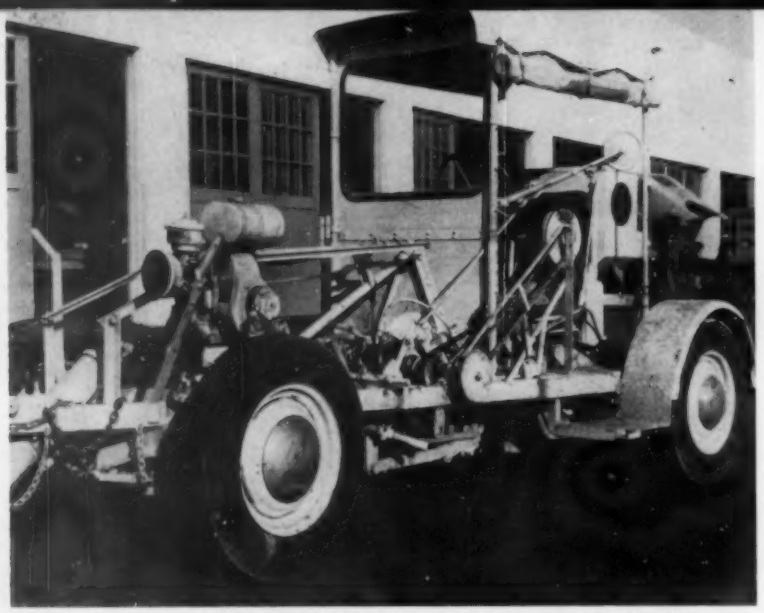
"From his experience with Euclids he decided that substantially built cabs on the machines would save the lives of the operators in cases of a jackknife or over-turn. His order for 72 of the largest Euclids that had ever been built specified that they would be equipped with cabs built out of boiler plate. These Euclids have been used for five seasons, hauled approximately 55 million yards of dirt and gravel without an operator being seriously injured.

"It is estimated that cabs have saved the lives of at least twelve operators during this period. The cabs built of boiler plate cost $150 more than the standard cabs built by the Euclid manufacturer. The embankment contractor feels that his cabs have paid for themselves many times over in the saving in lives during their operation on this project."

Pipe jetted under road

An unusual boring machine is used to install pipeline road crossings for an oil gathering line system near Amelia, Tex. Bill Murry & Co., of Beaumont, put through twelve such crossings under blacktop roads where permission to ditch through could not be obtained. Murry used an International TD-14A crawler tractor with side boom, a TD-14A dozer, and a TD-9 with a road boring machine of his own design which loosened the soil in the bore with a series of water jets. After a tractor pulled a swab through the bore on a chain, a clean hole was ready for the heavy road casing to be moved into position as shown here.

● Pipe being snaked under road.



● A paint strip brush device is mounted ahead of the paint-gun on this striping machine.

Another tractor-mounted compressor

More and more frequently tractors are seen on projects today carrying compressors mounted on them. An example is the one pictured, which is an Allis-Chalmers HD-7 Tractor with an Atlas-Copco CT-4 compressor. Two 2¾-in. rock drills and a pneumatic boom are operated from the installation, utilizing a standard power take-off arrangement.

In addition to maximum mobility for the compressor, the tractors full utility has been maintained. A water tank trailer can be quickly attached by drawbar hitch for wet drilling.

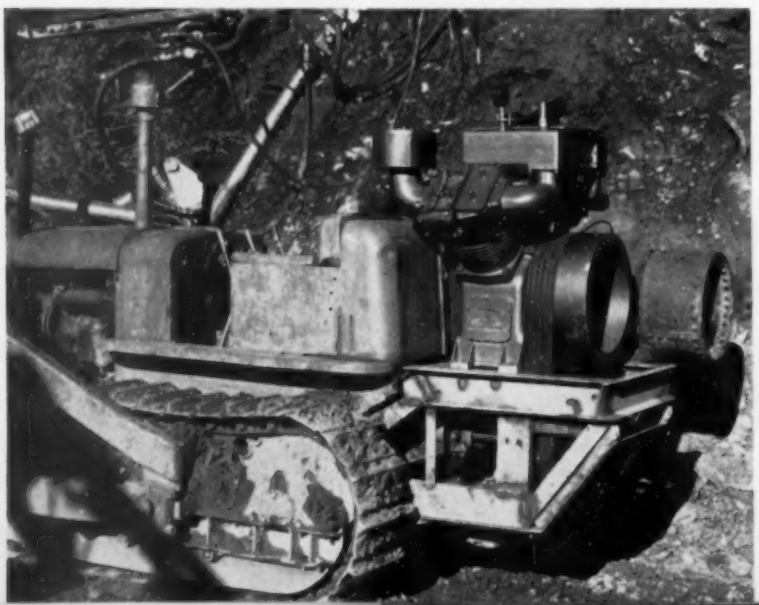
This machine was assembled for cinnabar ore work for a California mine. With this compressor rated at 185 cfm and 100 psi, the outfit is presented as a good idea for possible use by roadbuilding contractors.

Stripe painter includes novel sweeping device

The rig pictured here, designed by equipment engineers in the California Division of Highways, is a stripe painting machine which cleans the old pavement off ahead of the paint spray.

The combination stripe line sweeper and paint-gun carriage was devised to help speed up the stripe renewal operation and to get the paint down more securely. The sweeper attachment is mounted immediately ahead of the paint and gun assembly. It consists of a gang of six 10 in. diameter brushes, each 2 in. wide, turning on a single shaft revolving at 2500 rpm. The mechanism is powered by a K-90-RT Kohler engine.

● Allis-Chalmers HD-7 Tractor with mounted Atlas-Copco CT-4 compressor.



Personals

DR. ANDREY A. POTTER, Dean Emeritus of engineering at Purdue University, has been selected to receive the annual award for meritorius service from the National Society of Professional Engineers. The award was presented at the National Society's annual banquet June 4 at the Bellevue-Stratford Hotel in Philadelphia. The award to Dr. Potter is for "his inspired teaching and sympathetic encouragement of individual students of engineering, his wise counsel in the field of engineering education, his leadership in raising the status of the profession, and his manifold services to the Nation."

A. A. Potter

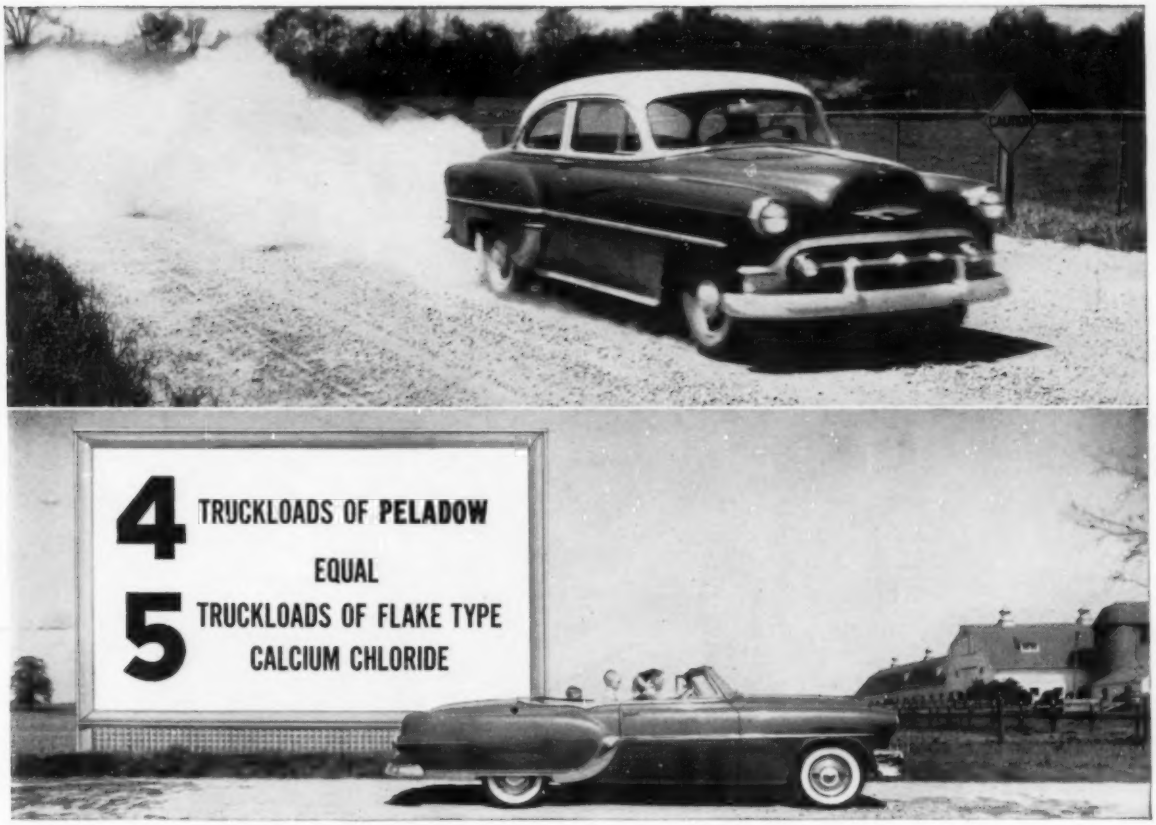
COL. CARROLL H. DUNN is appointed Executive, Office of the Chief of Engineers, U. S. Army, effective July 18, 1955. He replaces Col. A. C. Welling, who will attend the National War College during the next term. Col. Dunn has been director of the Waterways Experiment Station, Vicksburg, Mississipi since 1952.

CARL F. WINKLER, County Engineer of Houghton County, Michigan, at Hancock, has been presented with a distinguished Service Award for his 25 years of service to the commission.

COL. JOHN G. LADD (U.S.A. Ret'd.) has been appointed Executive Secretary of The Association of Professional Photogrammetrists. The Association headquarters is 17 Dupont Circle, N.W., Washington 6, D. C.

JOHN J. NARY retired deputy chief engineer, Triborough Bridge and Tunnel Authority, died recently at age 69. One of the chief engineers on important tunels in the New York area, he had served New York City since 1910.

DOW



DUST-FREE ROADS ECONOMICALLY WITH PELADOW

Highly concentrated DOW calcium chloride saves work and expense by cutting the quantity required by 20%

Peladow® keeps dust down to give you safer roads with better visibility on which traffic can move at a brisker, steadier pace. But the benefits don't end there! Roadside houses and business properties are relieved of dust nuisance, too. Crops grow better and bring better prices when they are free of dust and dirt.

Peladow in the form of buckshot-size pellets, applied to dust areas, draw moisture out of the air, keeping the surface damp and firm. Roads can't "blow away" due to heavy traffic and hard winds. Less frequent gravel replacement is required; savings in material and labor costs are achieved.

Because Peladow is a highly concentrated (94-97%) form of calcium chloride, *four truckloads of Peladow equal five truckloads of flake-type calcium chloride.* This means savings in shipping, handling and storage as well as less material to apply. In addition to 100-lb. bags, Peladow can be shipped bulk in hopper cars. Get the complete story on how Peladow or Dowflake® (Dow's flake-type calcium chloride, 77-80%) will make your roads better, more economical to maintain.

Write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. IN 993C-2

. . . for more details circle 182, page 16

you can depend on DOW CHEMICALS

DOW

Most Modern Trucks on

Chevrolet's handsome new Task-Force models answer your job needs with the most modern design and engineering features the trucking industry has ever seen.

CHEVROLET

Styling that speaks for itself—and speaks well of you and your business! Styling that catches the eye and serves as an on-the-job advertisement! You'll notice *two* distinctively different design treatments are offered—one in light- and medium-duty models, the other in heavy-duty jobs. It's functional styling, too. The new panoramic windshield adds to all-over design appeal—and inside it's even *better looking*—with a wider, safer view of the road. Chevrolet's new Safety Step running board is *concealed* and stays free of snow, ice or mud. Drivers will especially like the broader, softer seats; the High-Level ventilating system that takes in outside air in all kinds of weather.

NEW CHEVROLET

Any Construction Job!

High-Voltage power saves on operating costs—saves time, too. All six new Task-Force engines are sparked by a husky new 12-volt electrical system. That means snap-of-the-finger starting even in cold weather, and boosted generator capacity. The high-compression power of these great valve-in-head engines keeps you running longer between gas stops.

Anything else? Plenty. Capacities go all the way up to 18,000 lb. G.V.W.—available in 2-ton models. Enough G.V.W. for practically any job! Frames are new—of 34-inch standard width to accommodate special bodies, and with more rigid, completely parallel side members. And there's new suspension, front and rear, to make the road a lot easier on the load.

Tubeless tires are included on ½-ton models at no extra cost. Power Brakes are standard on 2-ton models, optional at extra cost on others. All models except Forward-Control are available with Power Steering as an extra-cost option. New Overdrive is now available on ½-ton models, optional at extra cost; Hydra-Matic, on ½-, ¾- and 1-ton models. There's more still, but call your Chevrolet dealer for complete details. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

Task-Force TRUCKS

. . . for more details circle 190, page 16

Organizing and Operating a Turnpike Job

From a talk given before the Sixth Annual Earthmoving Conference, sponsored by the Central Illinois Section, Society of Automotive Engineers, Peoria, Illinois, April 13-14, 1955.

By Nello L. Teer, Jr.
President, Nello L. Teer Company, Durham, North Carolina

RECOGNIZING that turnpikes, as such, are not new or modern, that as works of man they will never be classified as one of the world wonders, that highways or turnpikes are essential to our progress, I trust we can approach our subject as most contractors do — as just another piece of work. Toll turnpikes differ from our modern expressways and thruways from a contractor's point of view in only one way — they are to be constructed in a "hell-u-va" hurry with rather large penalties for late completions, so they accordingly require more equipment, personnel and overtime which per se result in higher cost.

The impact of turnpike construction on the contracting industry is not necessarily good, due to the "feast or famine" aspects of the program. The highway contracting industry, I am sure, would much prefer a more level, consistent program; a program that would enable plant expansion to be more orderly and more uniformly depreciated. Due to the extra large plant requirements, turnpikes are usually built by "foreigners" who follow the turnpikes in an effort to simulate a uniform program of work for their expanded personnel and plant.

To follow our trade, it is of course necessary for us to know where and when turnpikes are to be built and this turns out to be the easiest part, because every trade journal, every equipment salesman, every dynamite or cement salesman, every bonding company and even the *Wall Street Journal* carry a running account of proposed projects. The next step is to request inclusion on the authority's mailing list and the prequalification data if required.

Some authorities require extensive prequalifications relative to experience, personnel, equipment and financial resources. When these matters have all been taken care of, and the plans and rights-of-way are available, a plan of work offerings is usually established that will place the work under contract in an orderly but expeditious manner. Generally bids are received two weeks after advertisements, with the work spread out so that bids are received on two or three projects a week. This enables the contractor to study the jobs, secure material and subcontractor quotations and prepare his bids.

It is our practice to secure as much advance information as possible and to "rough in" the entire turnpike prior to receiving of the first bids. This enables us to plan our bidding in light of the personnel and equipment that we have coming available. It is of course obvious that no one contractor can do all the work and we accordingly recognize our limitations and in some instances the strong or weak points of our competitors.

With the more interesting jobs to us noted, we are ready for the receiving of bids. We will bid many or all of the projects, but bidding higher on projects we do not desire and lower on jobs suited to our particular conditions. We do this to get the feel of the market, and to try to confuse our competitors. Realizing that everything must be within reason, we as contractors desire to make as much profit as possible which explains our desire to get the feel of the market.

Cost estimating on highway work is far from an exact science; estimates though can be quite similar. Under similar conditions a 2½ yd. shovel or an 18-yd. high speed scraper will produce as much for our competitor as it will for us, and as long as we have similar equipment and can develop no ingenious approach we will develop similar cost estimates. The percent of contingencies and profit, however, are a different matter. If we're feeling the market and are not particularly interested in the project, we naturally add a higher profit and contingency, and if, by chance, we are the lowest bidder, then we feel that we are being compensated for the extra effort or additional capital investment required. Naturally, the securing of these types of contracts are few and far between. The final pricing of a contract is considered by some as being similar to playing poker; you try to hide your true interest and only seriously ante-up when you think you've got what it takes to do the job.

The actual cost estimating is laborious and undramatic. In most instances

Highlights of a talk directed to equipment designers, by one of the nation's largest roadbuilding contractors.

- *Estimating and bidding continues to be the big immediate management job of contractors.*
- *Contractors who build turnpikes are forced to become migrants, following opportunities from state to state to get steady work.*
- *In his equipment, the contractor wants reliability, reserve, including plenty of horsepower, and low final cost rather than low first cost.*
- *The trend continues toward larger capacity shovels and other equipment for turnpike work.*
- *Personnel to manage jobs is a foremost contracting problem. If Congress enacts a big new road program, the question is whether adequate supervision can be developed quickly enough.*

What a Contractor Wants in His Equipment

The contractor's first requirement in equipment is "reliability." This means equipment that is properly designed to do its job with a minimum of maintenance and down-time. With equipment available for use a larger part of the time, the contractor can plan his work with assurance and take advantage of weather conditions and thereby complete his work with a minimum of capital equipment and a resulting lower cost.

The contractor's second requirement for equipment is "reserve"; ample horsepower to do its job under adverse conditions, ample strength to take that unexpected shock or strain.

Entirely too much equipment is underpowered and if there is anything that will make a contractor unhappy it's seeing equipment too weak to maintain production; trucks that have to shift down to low-low on normal construction grades or wet and muddy haul roads; power shovels that cannot hoist the bucket up through the bank without stopping to let the engine "rev" up; axles, clutches and transmissions that only last weeks instead of years; tires that blow out due to inadequate carrying capacity.

I realize one of the stock replies to such complaints is that additional "reserve" will cost more money, but I say to you as one contractor, *first cost* is not what we're interested in; we're interested in *final cost*. Ample "reserve" built into the product means lower maintenance, less down-time and correspondingly lower unit cost.

The contractor's third requirement is "capacity." Turnpikes generally mean large quantities and the greater the unit's productive capacity the lower the final cost. Everything else being equal, larger units are more desirable. Labor cost, including the fringe benefits, etc., have risen so high that unit production must be increased to keep construction cost in line.

Within the past year or two the number of contractors using 4 to 5 yd. shovels and 20 to 25 yd. trucks with supporting equipment to match, have increased considerably and it is my considered opinion that within the next 5 years, you will find 4 yd. shovels as commonplace on highway work as 2½-yd. shovels are today. Manufacturers of this larger equipment will have to give more thought to transportation problems due to increased weight and dimensions. At this point let me enter a plea to some manufacturer to design and market an over-the-road truck tractor and low boy trailer with enough aluminum or alloy components to help overcome gross weight limitations now in effect on our highways. In many states today we can only move the present large crawler tractors, without attachments, on permits that cost so much a mile and only after you have made expensive telegraphic or telephone request and waited from 12 to 72 hours, and then found that you must go 100 miles out of your way in order to follow the designated routes.

We need big and sturdy equipment, but whether you design and build big equipment or little equipment, for heaven's sake give us *good* equipment. Equipment should be adequately field tested by contractors before marketing inasmuch as the so-called test farms don't begin to reflect a contractor's usage.

the location of the project must be walked, and in the more mountainous areas this most often develops into quite a chore with many blisters and sore muscles.

From information secured in visually covering the project, the contractor is better prepared to interpret the plans and specifications furnished by the engineering representatives of the owner. In some cases, subsurface information is furnished as developed by auger holes, core drills or electric resistivity test, to help the contractor determine the various amounts and types of excavation involved. Bids are received on excavation on an unclassified basis. On the basis of unclassified excavation the contractor assumes the entire responsibility; if he miscalculates the total amount of rock, it will result in greatly reduced profits or large losses depending on the degree of error.

The next important item to be determined is the length of haul, which information completes the necessary data that will enable us to select the type or types of equipment we will need for this project. A study of the specifications establishes the required time limits, penalties, etc., with quantities, hauls, classifications of excavation, completion dates at hand, a study of the past weather records enables us to determine the quantities of the various types of equipment we will need.

A study of the paving specifications develops the need for purchases of certain materials — and in some cases, where the quantities are sufficiently large or commercial sources too distant or too high priced, the interested contractors will search out quarry sites, sand or gravel deposits. These studies are quite often very extensive inasmuch as the contractor must know that the material meets specifications, is in sufficient quantity, can be secured at an agreed price from the property owners and can be produced more economically than other materials can be purchased.

Many quotations on such materials as lumber, cement, dynamite, fuel and gasoline, sand, stone, asphalt, pipe culverts, grass seed, guard rails, must be secured. Bond prices, insurance costs, information on various state taxes and regulations, sales taxes when and where applicable, and freight rates, must also be determined. Data on wage rates, union practices, including fringe benefits, "feather-bedding" tactics, etc., are extremely important inasmuch as total labor cost represents roughly one-third of the job cost.

Job Plan Developed

When all the information we have discussed is determined, a plan of construction can be developed and from it a cost of operations. From this basis a bid is born and if it is determined to be the lowest submitted, the contractor has an opportunity to carry out his plan and to finally determine the accuracy of his preliminary estimates.

To develop the low cost resulting in the lowest bid the contractor had to make the right choice of equipment, the proper determination as to weather, materials and labor conditions. Competition will not allow him to make ultra-conservative estimates; unnecessary padding will be a high bid.

A contractor constantly strives to be in a better competitive position than his competitor, and his most fertile field for this lies in his choice of and use of his equipment. The necessary equipment to successfully carry out a

rush turnpike job represents quite a large capital expenditure and the contractors equipment selection can accordingly make or break him.

In conclusion, let me say that to be successful on a turnpike contract, one must have a proper bid, good equipment and a well-conceived plan of operation. Given these three essentials, the operation of the project becomes routine. Unfortunately, however, we have "gremlins" in the construction industry and as it has been said, "The best laid plans of mice or men often go astray." Equipment will break down, weather is unpredictable, estimating is not an exact science and to err is human, so the contractor must have personnel capable of adjusting for job developments, and here we finally find the true secret of success for a contractor. The strongest link in his chain is his personnel. Given strong supervisory people a contractor can even succeed with your competitors' products. The great problem of carrying out an expanded highway program as now under consideration by Congress is, "Can we develop adequate supervision in time?" Unfortunately, ingenious designers can't mass produce them for us, but you can make our tasks immeasurably easier if you will give us construction machinery that will perform adequately as your sales literature and salesmen profess.

Forgotten Tricks in Shovel Production

Excerpts from a talk given by Q. J. Winsor, Manager of Sales Development, The Thew Shovel Company, at The Society of Automotive Engineers' Earthmoving Industry Conference, Peoria, April 13-14, 1955.

IT SEEMS to me that the war years of plenty of work and shortage of equipment and inflation of dollars created a condition that should be recognized. This is of assuming that work is being done the very best way at the least cost. I think these war years got many people into bad habits.

Fifteen years ago I could get better cost records for earthmoving from small operations in mining and contracting than I can today. They knew what each shovel produced on its shift. Many knew their machine-hour and cubic-yard or ton costs and many knew their operating supply costs and maintenance costs per cubic yard or per ton. They recognized optimum height of bank — hoist time and swing time as affecting machine cycle time.

•

I certainly got a kick recently when I talked to an owner who shortened the boom of a loading dragline from 45′ down to 40′ because he knew he could load more material with faster cycle time.

The older operators seem to plan their work — know little tricks to get out more yardage — think more about production.

•

I've never forgotten the story told me by an old steam railroad shovel owner. How, when he first got his chance to crane the machine. The owner stood things a while and then called the craneman down off the boom and handed him a nut tied to a string — to practice with. I didn't get the point and he didn't originally either — so the owner showed him — as the radius of swing is decreased, the speed of swing increases.

All the owner wanted was to have his craneman rack the dipper in closer as the boom was swung, and rack it out to slow up the swing just before he dumped the dipper. How many people think of that principle today when running or owning a revolving shovel? The resistance to swing varies as the square of the radius to each particle of the machine. When the loaded dipper is the farthest out it has a great slowing affect. Try some curb-stone figuring and prove it to yourself.

•

You know that a shovel is faster than a clamshell, but a clamshell pitched into a stockpile at truck-body height will load more material than the same size shovel starting every pass at grade.

•

Digging top off first with a shovel or scoop shovel, reduces hoist time required and eases the digging in the lower part of the bank, but it is hard to teach this to people.

•

A dragline bucket is filled within the first few feet of drag, but many operators pull the crow's foot into the fairlead before they stop dragging — wasting time, power and drag brakes unnecessarily.

•

I've seen some records made loading stockpile coal to railroad cars with a dragline sitting on top of the coal pile, but try to convince the people who think that a clamshell is the best way to do this work.

•

Why do I bring these points up? Are they occasional conditions or do they point to a trend?

Well, I'm willing to accept the large production jobs with experienced superintendents generally — but I'm concerned with the millions of earthmoving jobs you and I are paying for. I think these examples do indicate conditions that should be watched for, thought about, and avoided.

I think that owners should find out — should know what a machine should and *can* produce, and then plan to get that production. That is the way to produce the lowest earthmoving costs with power shovels or any other equipment.

New York Port Authority is big business

The New York Port Authority which operates toll tunnels, bridges, and the airports of the New York metropolitan region had a gross income in 1954 of $64,111,850.

In its annual report for the year, the Authority revealed that 65% of this record gross revenue came from tolls from motorists and truckers, the tolls totaling $41,460,898. Over 81 million individual toll collections were transacted for passenger cars, trucks, and buses — 3.9% over the previous year. Airport revenue reached a new high, totaling $12,101,079.

The Authority's 17 facilities are valued at $519 million. Authority bonds (outstanding total $246,770,000) and the agency has a reserved fund of nearly $31 million at present. According to Howard S. Cullman, chairman of the Authority, the organization is in a good position to carry its $300 million share of the cost of toll bridges and improvements, planned jointly with the Triborough Bridge Tunnel Authority,

During 1954, nearly 30 million traffic volume was recorded on the George Washington Bridge, 16 million through the Lincoln Tunnel, 14,960,000 through the Holland Tunnel.

PHOTO COURTESY WORTHINGTON CORPORATION, HARRISON, N.J.

Chrysler High-Speed Power and Fluid-Coupling protection ready this mixer for big season ahead

"Guestimates" differ as to how big a year lies ahead in building. But we do know that public projects, commercial and home construction will set records in practically every part of the country. And from that we can logically assume that transit mix truck operators will be among the busiest people in the nation.

By the same token, engines powering transit mixers must deliver top-performance on a scale never before approached. Wear and tear on engines, transmissions and equipment will be tremendous . . . "down time" will be avoided like the plague. Most manufacturers have wisely prepared equipment for sustained top performance. They have powered with power-proved Chrysler Industrial Engines and are ready for the big job ahead.

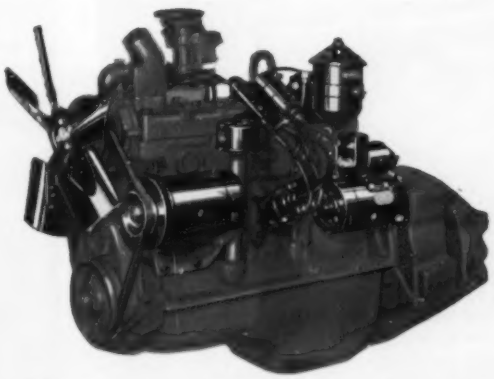
Pictured here is the Worthington Model LO 4½ Yd. Transit Mixer equipped with stationary hopper pouring footing for a commercial building in Ohio. While the compact Chrysler Ind. 30 Engine is placed immediately behind truck cab, drum rotation and drum speed may be controlled from either end of running board. This model is designed for fast charging and discharging.

Between the Chrysler Ind. 30, 230 cubic inch displacement engine, and the Worthington heavy-duty single lever operating transmission is a Chrysler gyrol Fluid Coupling. In this way Worthington protects driving and driven members from wear and tear imposed by shock loads, adds materially to clutch and transmission life.

When lightweight, high-speed, high-output power in a small, compact engine is indicated, check the Chrysler Industrial Engine Line, 230 to 413 cubic inch displacement. And remember, Chrysler Industrial Engines are not expensive. Production-line methods adapted to specialized industrial engine building provide custom-built engines at mass-production prices.

See a Chrysler Industrial Engine Dealer or write:
Dept. 126, Industrial Engine Division, Chrysler Corporation, Trenton, Michigan.

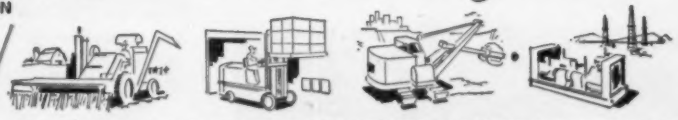
CHRYSLER INDUSTRIAL 30 ENGINE
—230 CUBIC INCH DISPLACEMENT



CHRYSLER ***Industrial Engines***

INDUSTRIAL ENGINE DIVISION • CHRYSLER CORPORATION

HORSEPOWER WITH A PEDIGREE



AGRICULTURE • INDUSTRY • CONSTRUCTION • OIL FIELDS

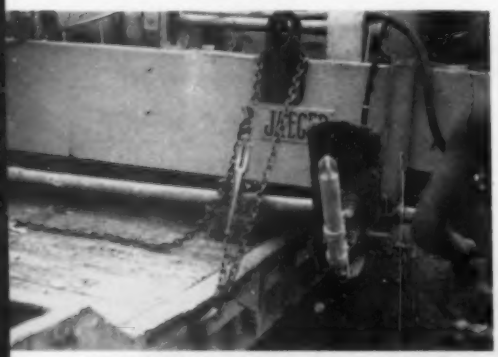
. . . for more details circle 174, page 16

HOW WOULD YOU DO IT?

One of a Series

1 On reaching a bridge deck, the paving crew of D. W. Winkelman Company, of Syracuse, New York, loaded the finishing equipment, a piece at a time on a trailer, using a Northwest truck crane.

2 The scene, by the way, is on Winkelman's 1954 Ohio turnpike job. Spreader being set on the flatbed.



3 The Jaeger spreader was fastened securely with a chain and ratchet at each corner. Note the lifting bracket welded on each corner of the spreader frame.

4 The bulldozer, at the left, has just given the load a shove to get it started down the ramp.

5 Here, the load is on its way up the ramp to the opposite side of the bridge, where another Northwest crane will pick the unit up and set it on the form rails for continuing paving. (Photos by ROAD AND STREETS staff.)

New Publications

Legal aspects of utility work reviewed

A major problem connected with the relocation, realignment, widening, and other improvement of existing highways is the relocation of public utilities that pass over, under, or along side of the roadway or otherwise share the highway right-of-way.

An extensive study of the state statutes and constitutional provisions and of the important judicial aspects relating to this relocation of public utilities has been completed by the Committee on Highway Laws of the Highway Research Board. The analysis of this research is released by the Board as *Special Report 21*, Relocation of Public Utilities Due to Highway Improvement: An Analysis of Legal Aspects.

The 200-page monograph includes an analysis of more than 250 of the most important judicial decisions and all statutory and constitutional provisions affecting public-utility relocation. From this research has emerged the pattern of legal relationships which now exist between the highway departments, the public utilities, and the public in general.

The study delineates the rights of public authorities in the highway right-of-way; the rights of public utilities established within such areas; the ramifications of the police power concerning whether utilities must move and who shall bear the cost thereof; the character of the federal-aid road-building program and its impact on the utility-highway relationships; the railroad analogy; and many other significant aspects of utility relocation.

Copies are available from the Highway Research Board, 2101 Constitution Avenue, Washington, D.C. Individual copies, $6.00.

Materials of Construction, Sixth Edition, by A. P. Mills, H. W. Hayward, and L. F. Rader; John Wiley & Sons, 440 4th Ave., New York 16, N.Y., 650 pages; $7.50.

The sixth edition presents an up-to-date revision of this standard text to reflect new and current data on types, applications and tests of construction materials. A new chapter on mineral aggregates has been included and discussion of concrete revised to treat air entrainment, proportioning, types of cement and physical properties in accordance with present standards and viewpoints. Other principal revisions include clarification of structural clay products; structural values of timber; and service requirements and behavior of metals. Detailed references are given at the end of each chapter where specific information can be obtained on particular applications and test methods of various materials.

This sixth edition was rewritten and edited by Professor L. F. Rader of the University of Wisconsin.

Glossary of Selected Geologic Terms. 2,700 of the more common geologic terms used by geologists, engineers, and professional men in allied fields, are defined in the "Glossary of Selected Geologic Terms" by Wm. Lee Stokes and D. J. Varnes, to be published as Vol. 16 of the Proceedings of the Colorado Scientific Society. Orders for this volume, at prepublication prices of $3.50 cloth bound, $2.75 paper bound. Send check to Treasurer, Colorado Scientific Society, Box 688, Denver, Colorado.

This glossary includes up-to-date definitions from specialists in teaching and commercial fields and from the authors' colleagues in the United States Geological Survey. Because the emphasis in selection of terms is slanted toward the overlapping field of engineering and geology, critics consider this publication as supplemental to, rather than competitive with, other important glossaries of geologic terms.

The Design Thickness of Concrete Roads. Road Note No. 19, price 10½ D (25 cents, U.S.A.). Department of Scientific and Industrial Research, Charles House 5-11 Regent Street, London, S.W. 1, England.

The Road Note reviews the present state of knowledge of design factors in concrete road construction. Recommendations are summarized in a table which lists the thickness and the amount of reinforcement to be used for a wide variety of traffic and soil conditions.

Analysis of Statically Indeterminate Structures by John I. Parcel and Robert B. B. Moorman. John Wiley & Sons, 440 Fourth Ave., New York 16, N.Y. 571 pp. Price $9.50.

The new book deals exhaustively with theory and provides a balanced account of its applications to special structural types. The general headings include: deflections by the method of work and by special methods; general theory of statically indeterminate stresses; special methods — selection of base system, elastic center.

The treatment of frames with curved members gives an extension of the slope-deflection equations to frames with curved members. This theory, contributed by Dr. Moorman and now printed for the first time, applies rigorously to certain types of curved members and approximately to a wide variety of forms.

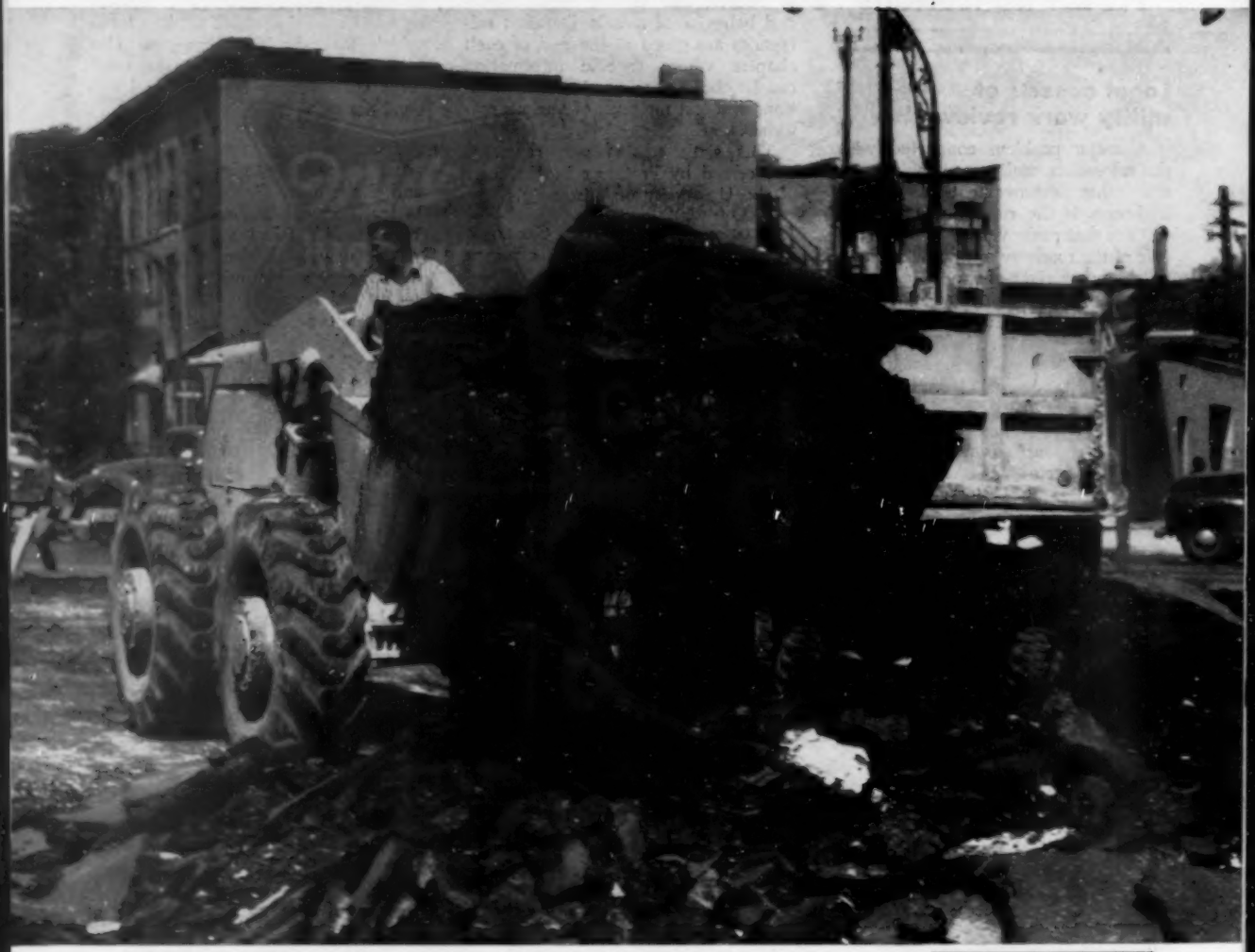
Maintenance on Peak

Late spring maintenance is about to begin in fixing up the Pikes Peak highway for the big summertime tourist traffic. As pictured here, boulders fall down on the highway and erosion causes damage which must be repaired by heavy equipment.

Careful maintenance and policing has kept this 20-mile highway up to 14,000-ft. summit accident-free for 39 years.

● **Pikes Peak auto road maintenance in progress, using International TD-24 crawler tractor with hydraulic dozer. City of Colorado Springs, which maintains and patrols the road, also uses equipment of this type for grade and line modifications and for snow and ice removal.**

This big POWERHOUSE



Stripping hot mix asphalt from its concrete base without benefit of scarifying! The MICHIGAN also demonstrates its ability to get a heaping bucket load even at ground level—and transport it only a few inches off the ground.

CLARK EQUIPMENT

Push-loading a scraper for A. J. Raisch, San Jose, Cal.—a real test of power and traction. You can use a MICHIGAN where you've never been able to use rubber-tired Tractor Shovels before—versatility that cuts your costs.

handles bigger jobs cheaper!

Look at these specs of the 2¼ yd MICHIGAN 175A

BUCKET CAPACITY	**2¼ cubic yards**
LIFTING CAPACITY	**15,000 lbs.**
HORSEPOWER: Diesel . . . 133; Gas . . . 126; Supercharged . . . 165	
WEIGHT	**24,100 lbs.**
SPEEDS	**Up to 27 m.p.h. Forward or Reverse**

Don't look for "comparative" data on the MICHIGAN 175A —there is *no machine comparable.* This big bruiser is nearly 50% bigger than the next closest machine on the market. It's literally in a class by itself. From fly-wheel to bucket, the 175A is built to do bigger, heavier jobs—jobs that no other rubber-tired machine can handle.

Better traction and flotation. With the MICHIGAN's exclusive power train—300% torque multiplication, power shift transmission (no engine clutch) and planetary wheel axles—you get a shockless flow of power right down to the ground. There's no surge, no wind-up in the axle shaft, no wild wheel spin. The operator has feather-touch control over his wheels; in weak soil conditions or mud, he can ease off or step up the power to keep from digging in. With this kind of smooth power transmission, you get the full advantage of the MICHIGAN's extra weight and power—you dig material *out*, you don't dig the machine *in*.

Independent power at the cutting edge. The 175A bucket action gives you independent power right at the cutting edge of the bucket. With two big double-acting bucket cylinders, you can ease up to a pile of tough material and dig your way into a heaping bucket load. On other machines, you'd have to ram headlong into the pile to try to get penetration—and you'd probably still get only half a load. We'll match the MICHIGAN's digging ability against any make or type of Tractor Shovel, bar none.

Hydraulic power does the work. In spite of its size and power, the MICHIGAN 175A is easier to operate than most machines one-third its size. Hydraulic power does all the real work: power steering, 4-wheel power brakes, power-shifting with two simple levers on the steering column, no clutch pedal.

Warning: don't let your operator get on a MICHIGAN unless you're willing to buy one! After an hour on a MICHIGAN, he'll not be satisfied with any other Tractor Shovel.

See it in action! We'll prove that the MICHIGAN is in a class by itself in the Tractor Shovel field: your local MICHIGAN distributor will arrange a demonstration—on your own job, if you wish. Or write for 12-page Tractor Shovel booklet containing explanation and cutaway drawings of the MICHIGAN power train. Any MICHIGAN is available on a low-cost Lease Plan—ask for brochure which explains how you can use it.

CLARK EQUIPMENT COMPANY, Construction Machinery Division, 394 Second St., Benton Harbor 30, Michigan—Phone WA 6-6184

6000-lb. steel truss, 60 ft. long, is transported from rail siding to steel-setting cranes on Austin Co. job in Michigan. The extra weight and power and inherent stability of the MICHIGAN Tractor Shovel give it the capacity to handle heavy yard-jobs like this.

Cold crusted asphalt tests the digging ability of any machine. Here the MICHIGAN breaks out a 9000 lb. heaping bucket load. When the operator steps on the brake, the power-shift transmission automatically goes into neutral—puts full power into the bucket action.

Research Summary

Plasticity Index and pH of Soils Show Little Correlation

Lack of sufficient correlation was finding of Texas experiments to provide rapid soil quality gauge

By Bob M. Gallaway

Assistant Research Engineer, Texas Engineering Experiment Station, Texas A & M College System

LITTLE correlation appears to exist between the physical characteristic of plasticity index of soils and the chemical attribute of hydrogen ion concentration. This fact became evident in recent research at Texas A & M College in which it was attempted to provide a faster method for determining quality of foundation or base course soils in earthwork construction.

No single test of a given soil sample has been devised that will delineate all the essential data for engineering purposes; however, the Atterberg Limits are probably the most frequently used as the master yardstick by construction engineers. In present practice, determination of the Plasticity Index from the Atterberg Limits requires about 1½ hours per sample with an oversight delay for moisture data. In the experimentation a search was made for a relationship between plasticity index and pH of soils with the hope that thereby a method could be developed which would bring soil-quality determination to a period of minutes.

The work, which based itself on science literature,[1] involved three phases — (1) direct pH readings on natural soils, (2) pH and settlement readings after addition of lime up to 10 per cent and (3) pH readings after treatment with buffer solutions.

The pH meter used in the research was a Beckman Model G. laboratory type (equipped with a normal range glass electrode and calomel electrode with a temperature range of —5 to +50° C.) advertised as sensitive to changes of 0.01 pH and in general accurate to ±0.05 pH up to a pH of 9.5.

This specific instrument was chosen for the advantages it afforded, particularly as follows: (1) no gas, catalytic surface, or auxiliary material being required; (2) adaptability to unbuffered solutions; and (3) suitability for use in colored solutions, semisolids, and thick fluids, and (4) in the presence of Ba, Ca and NH_4OH of high concentrations (provided sodium salts are absent).

The soil samples used in the experiments were typical of those used as base course and subgrade on Texas highways and farm to market roads. The pH's on 40-mesh fractions of 100 such soil samples at 1:5 soil-water ratio showed no correlation with the plasticity indexes.

The pH meter has been used by agricultural scientists for determining the amount of lime required for proper growth of plant life. In such research it has been found that soils of the same original pH will require vastly different quantities of lime to produce the same effect and that soils of high clay content and a given pH require more lime than do soils of high sand and silt content with the same pH. Since lime causes an exchange reaction in many soils and binds soil particles chemically as well as physically, it was reasoned in the Station's research that a soil sample might be treated with varying amounts of lime in a water solution and the reaction studied for additional data. The amount of settlement, for example, then might give an indication of soil's physical characteristic of plasticity index.

Lab Procedure Details

Such an experiment was carried out in the laboratory. Six 5-gram samples of each material were weighed into 25-ml graduated cylinders; hydrated lime was added to five of these samples in two per cent increments from two to ten per cent; the sixth sample was used as a control. The soil-lime samples were mixed dry and then boiled distilled water was added to bring the volume of all samples to just less than 25 ml. Then the samples were again stirred and subjected to vigorous shaking for a period of two minutes. Following this, the samples were brought to exactly 25-ml volume and again subjected to vigorous shaking after which each sample was allowed to settle for a period of 15 minutes; settlements were recorded. The amount of settlement was again read at the end of 30 minutes. The plasticity index appeared to be a function of the amount of settlement. The pH of these same samples was taken after 30 minutes equilibrium time, and again after fifteen hours. The pH did not change appreciably after the first 30 minutes of reaction time. Where a change was evident, it was in the direction which lowered the pH. This lowering may be accounted for, at least in part, by base exchange and by absorption of CO_2 from the air. An indication is evident, that the chemical reaction between the soil and the lime in a water solution is essentially complete in twelve to fifteen hours and that three per cent lime satisfied the base exchange capacity of most of the soils tested. Some samples, however, required approximately six per cent lime before essentially constant pH readings were obtained. These later mentioned samples, without exception, were fat clays. This corroborated previous Station work[2] on the stabilization of clays by the use of hydrated lime in which approximately six per cent lime was found to be the average maximum required.

The usefulness of buffer solutions in determining exchangeable hydrogen limited itself to soils of low exchange capacity in the third phase of the Station's research. Two samples of 2.5 grams each of air dry — 40-mesh material were weighed into 50-ml beakers. To one of these was added 25 ml of normal neutral ammonium acetate and to the other was added 25 ml of normal acetic acid. The mixtures were stirred and covered with watch glasses. After 30 minutes of equilibrium time the pH's were read. A pH reading was taken again after approximately 15 hours equilibrium time. In the case of the acetic acid soil mixtures the pH after about 15 hours reaction time was for all

[1] Brown, I. C., "A Rapid Method of Determining Exchangeable Hydrogen and Total Exchangeable Bases of Soils," Soil Science 56: 353-358. 1943.

[2] "Lime Stabilization of Clay Soils." Bob M. Gallaway and Spencer J. Buchanan, Texas Engineering Experiment Station Bulletin No. 124. 1951.

practical purposes the same as it was after 30 minutes. This, however, was not true for the ammonium acetate-soil mixtures. The pH at the end of 30 minutes and at the end of 15 hours varied as much as 0.17 pH units with no definite trend. A total of 42 samples was treated with neutral normal ammonium acetate. The pH of all these samples fell within the range of 6.45 to 7.42. In general the basic soils gave pH values above 7.0 whereas the acid soils gave pH's below 7.0 after treatment. There appears to be no relation between the pH of the raw soils above or below pH 7.0 and the pH of the soils after treatment. Also, the pasticity index and pH of the treated soil samples are not interdependent.

Negative Conclusion

There appears to be no correlation between exchangeable hydrogen and pH. The change in pH as caused by the ammonium acetate is toward pH 7.0 with only one exception regardless of whether the original pH of the soil was above or below pH 7.9.

Graphical plots of the data taken on the depressed pH of soil samples treated for 30 minutes with normal acetic acid compared with those of plasticity index showed no correlation.

It was not possible with the data taken into this phase of the research to plot total base exchange (interpreted as the sum of the exchangeable bases of sample plus the exchangeable hydrogen) as a function of the plasticity index of the soils tested due to the inadequacy of the pH method as an exchangeable hydrogen determiner.

Rather poor correlation between the depressed pH of the acid soils that were tested and the plasticity index of these samples was indicated — the depressed pH of the soils treated with acetic acid being a measure of the exchangeable bases of the sample.

Starting salaries reported

Starting salaries for beginning engineers reached an all-time high for graduates of the Illinois Institute of Technology in Chicago, according to a report from this institution. A survey of the January graduating class revealed that the average beginning salary was $383 per month, or $10 more than a year ago.

Highest starting pay was reported for chemical engineers, biggest increase occurred in the mechanical engineering field. Only decline was in the civil engineering group where starting pay dropped from $388 in January a year ago to $378 this year.

Employee publication kids company estimators

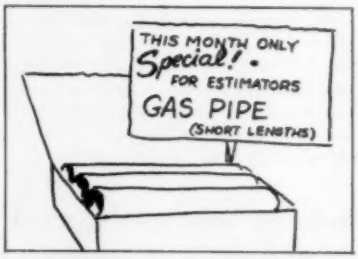
Employee publications are put out by a number of the larger contractors these days. One example is "Hendrickson News" published by Hendrickson Bros., Inc., general contractors at Valley Stream, New York.

A recent issue of this lively little sheet took the firm's estimators for a good natured ride by publishing the results of competitive bids on several jobs the company was gunning for. "The less said, the better," said this magazine in connection with the company's failure to land any of the seven jobs on which it entered bids in February. "Public bidding in the month left Hendrickson entirely out of the running! See for yourself!"

The word "Devastated" appeared at the top of a list of bids on one job, where Hendrickson estimated $533,000 compared with $493,000 low bid.

"Drubbed" was the word for another job where Hendrickson was eighth among the ten bidders, bidding $86,000 compared with $69,000 low bid. On still other jobs, with similar epithets, the publication reported the firm as varying from second to seventh place in the bidding. Bids on jobs in the company's work area for the month range from five to fourteen bids per job, with a spread of as much as 60% between the high and the low bid.

The cartoon reproduced here is also a part of the atmosphere of kidding, used to keep the staff in good spirits in the midst of very tough competition.



- Hendrickson staff magazine lampoons firm's estimators.

First quarter awards up 52%

Highway awards in the first quarter of 1954 rose 52% over the corresponding quarter of 1953, according to the latest compilation.

This is part of a record-breaking $4.4 billion engineering awards compared with $4.0 billion for the quarter a year ago for all types of construction in the U. S.

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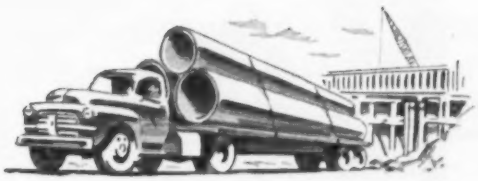

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GEO. M. BREWSTER & SONS, INC. ADDS 4 NEW LORAIN 85's

THE SEVENTY-SEVENTH LORAIN— to be purchased through the years by George M. Brewster & Sons, Inc., Bogota, N. J., is the new Lorain-85 shown above. It's one of four new "85's" just added to the fleet of this well-known contractor, two of which were immediately assigned to the New York Thruway job. Brewster's contract calls for 2½ million yards of grading on a 4.7 mile section near Nyack. The Lorain-85 is digging a mixture of clay and rock with a 2½-yd. dipper and a 26-ft. boom. Brewster's repeated confidence in Lorains tells all that can be said about profit-making performance.

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- WIDER CRAWLER • with 2 speeds in both directions.
- REMOVABLE COUNTERWEIGHT.
- TORQUE CONVERTER available.

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THEW LORAIN®

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Maintenance and Patrol Methods on New

By Charles M. Noble

Chief Engineer, New Jersey Turnpike Authority, New Brunswick

MAINTENANCE on any highway is an exacting job requiring a high order of know-how, skill and organizational teamwork. On a turnpike or toll road the public expects an even higher standard of maintenance than on the public highway system. In addition the controlled access features of a turnpike impose additional responsibilities in policing, service features such as oil and gasoline, roadside aid, fire fighting, ambulance and first aid services. The ordinary maintenance features on toll roads and organizational set-up will be outlined before discussing the unique special features that complement normal maintenance services. Because of familiarity, the organization and procedures on the New Jersey Turnpike will be presented.

The Turnpike is divided into three divisions, 49 miles, 42 miles and 27 miles long; each headed by a Division Supervisor. Both are divided into two districts each headed by a foreman.

This maintenance organization operates 258 pieces of equipment which are serviced and maintained by a Central Shop, under the direction of a master mechanic. In addition, the automotive equipment assigned to the staff members of the Authority is maintained by the Shop. Traveling mechanics operate from the Central Shop to inspect equipment in the field and supervise the operations of division mechanics who perform routine maintenance.

As presented at the annual meeting of the Association of Highway Officials of the North Atlantic States, held at Atlantic City, N.J., March 2-4, 1955.

Because of the large amount of electrical, plumbing and mechanical equipment, including toll collection apparatus, area lighting, air conditioning, sewage treatment plants, water supply, plumbing and refrigeration equipment, a special mechanical-electrical team functions throughout the Turnpike. A radio engineer and an agronomist complete the staff.

As basic policy, preventive maintenance doctrine is followed and mechanization is the order of the day. Each task is analyzed to determine whether the work can be done effectively by machine or other mechanical equipment.

For example, ice control is handled by salt, spread by special salt body trucks equipped with mechanical spreaders under cab control by the driver. These units operate in 7-mile sections. This not only insures quick action necessitated by the high degree of service required on a turnpike but also results in top efficiency. The salt body trucks are loaded in 8 to 10 minutes by mechanical loaders.

A feature of the grass cutting program (11,000,000 sq. yd.) is the low center of gravity Worthington tractor with dual tires operating a 6-ft. sickle bar, which permits mowing on 2:1 slopes; and a gang rotary gasoline powered mower which will cut a 16-ft. swath at each pass. These machines make short work of high tangled weeds and leave a chopped up mulch that retards erosion and provides humus. Incidentally, mowing operations are timed to cut weed growth before seed matures in order to gradually eliminate weeds from the right-of-way altogether.

Where standard commercial equipment is not available on the market, special equipment is developed in cooperation with reliable and experienced manufacturers. A special high level electric light service truck to handle the 30 ft. high pole bracket arm mounted lights, a special truck mounted traffic paint line marking machine which will lay two 6-in. lines of paint simultaneously and a flossing machine for spraying lime, fertilizer and grass seed have been developed to date. Under investigation is a vacuum type machine for picking up the excessive amount of litter thrown out of vehicles by Turnpike patrons.

In the design of the Turnpike, preventive maintenance was originally designed into the facility and included in the construction contracts to as great a degree as feasible, such as treatment of guard rail posts with a preservative, hard surfaced shoulders flanked by a 6-ft. grassed berm to eliminate the necessity of scraping or blading, which would have been almost prohibitive under the heavy traffic experienced on the Turnpike. Side slopes to ditches are limited to 4:1 and no slope is steeper than 2:1. All slopes and disturbed areas were topsoiled, fertilized, limed and planted to grass seed. Trees were cleared back sufficiently to avoid falling trees encroaching on the travelled lanes. Drainage pipe systems were designed on the self-cleaning principle with a minimum velocity of 3-ft. per second when flowing ¾ full. Generally it takes two seasons to establish vegetative growth sufficient to control erosion. Consequently, it is recommended that as much seeding be done under initial grading contracts as possible.

In a number of instances fill settlements have necessitated an overlay of asphaltic concrete to fill up depressions. Because of high standards on the Turnpike and the desire to furnish unexcelled transportation service, special procedures were developed for this work. Briefly, these procedures are:

(a) Restore the original high degree of smooth riding quality.

● Specially designed high-speed striping equipment in action on the turnpike. The inner edge as well as centerline of each dual roadway is kept well maintained with a white stripe.

Jersey Turnpike

● Flossing equipment as developed by the turnpike maintenance department.

(b) Retain the original non-skid properties.

(c) Provide high stability against distortion and shoving.

(d) Provide substantially the same texture, color and appearance as the adjacent pavement.

The above is accomplished by a close approximation of the original gradation of the stone and sand aggregates; adherence to the original design mix; utilization of the same aggregates as used in the original mix to achieve reasonably close color matching and the use of machine laying whenever feasible, reducing hand raking to an absolute minimum. An engineering survey party takes profiles and new grades are laid. The survey party sets stakes or pins and wire guides are used to assist the spreader operator.

Safety on the Turnpike is paramount. This not only applies to Turnpike patrons but also to Turnpike personnel and rigid safety rules and requirements are enforced when working within the roadway areas.

During the winter, U. S. Weather Bureau reports are furnished on a regular schedule supplemented by special reports from Airports when bad weather threatens. At the first sign of snow or icing, equipment is deployed along the Turnpike and plowing starts as soon as there is enough to plow. Ice control is handled by application of rock salt.

The over-all maintenance organization, so far as the number of men employed is concerned, is determined by the summer work load during the grass cutting season.

So much for routine maintenance. In addition to those features normally associated with maintenance a Toll Road must provide additional services for the comfort, safety and convenience of the public.

This may not seem a large order but when it is considered that the average daily traffic in 1954 amounted to 67,275 vehicles and during the summer exceeded 102,000 on some days, it is realized that adequate facilities must be made available for this population. When it is considered that on an average day some 165,000 persons populate the Turnpike it may be seen that services have to be available to serve what is equivalent to a fair sized city.

It is necessary to maintain the radio system, the water supply wells and water treatment plants, sewage treatment plants, the various buildings including administration, toll, utility, maintenance and service buildings which latter are air-conditioned, area lighting, toll collection equipment, accounting and tabulating equipment and stand-by generators.

For example, the radio set up contains 96 mobile units, 26 fixed stations, 7 micro-wave stations and 5 base mobile repeater stations plus 30 emergency motor generators to furnish stand-by power to the radio and toll collection equipment in case of power failure. Toll collection equipment in the field has nearly 500 pieces of highly specialized units in constant operation, much of it recording record levels of traffic. This equipment alone requires a stock of 18,000 spare parts. Miscellaneous items consist of operating 20 steam heating boilers, 230 thermostatic heating units, 1300 area lights, 196 pieces of air-conditioning equipment and 1600 electric motors.

To serve the public, the Turnpike has established the following services. A 77-man police force which is an integral part of the State Police and which utilizes a modern micro-wave automatic repeater radio system for quick communication, 10 service areas (5 on each side of the Turnpike), patrol service by concessionaire for breakdown, flat tire or out of gas cases, arrangements with private garages for repair, towing and wrecking services, arrangements for first aid and ambulance and fire department availability.

Contrary to ordinary understanding, the State Police detachment functions as a service force to promote safety and aid distressed motorists as well as restrain violators of the law. In 1954 this force of 77 men operating around the clock gave aid to 44,461 stranded motorists. In addition as part of their enforcement work they passed out 23,865 summons of which 18,899 were for speeding.

The gasoline, oil and auto services are handled by Cities Service Company, who, in addition to the service stations, maintain service trucks equipped with two-way radio.

As a matter of interest it may be well to know that the State of New Jersey and the Federal Government received last year about $1 million from gasoline tax proceeds earned on the New Jersey Turnpike. The Turnpike got not one cent. In addition the Turnpike pays the full cost of the police detachment including training and retirement. In 1955 this will amount to $625,000, whereas the fines from Turnpike violators in the amount of $267,545. (1954) goes to the State and costs of $119,526 to local subdivisions of government.

- The 118-mile dual pike is divided into three maintenance divisions, each with two district foremen.
- 258 equipment units are supported by a central shop, traveling central-shop mechanics, and division shops.
- A special electrical-mechanical team covers the entire turnpike, maintaining lighting, water and sanitation facilities, etc.
- Preventive maintenance of equipment is emphasized.
- Mechanization example: salt trucks are mechanically loaded, salt is spread on 7-mile patrols using spreaders operated mechanically from driver's seat.
- Grass cutting program on roadsides speeded by mowers which can ride 2:1 slopes, with gang mowers for 16-ft. swath when usable.
- Emergency traffic service is a major problem. A 77-man police unit is attached to the turnpike.

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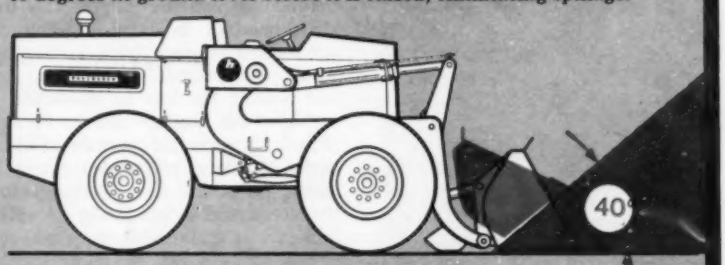

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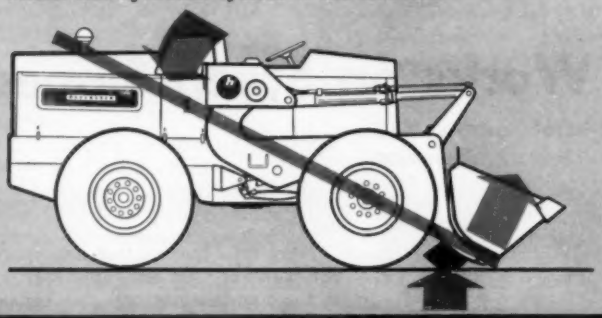

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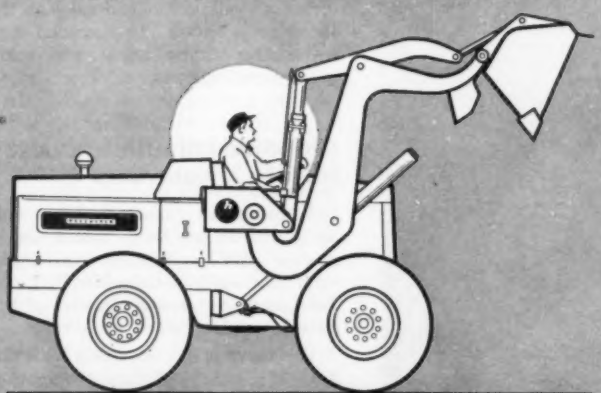

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Fullest operator visibility for safe, fast maneuvering; power-steering; minimum number of control levers. Foam-rubber molded seat and back cushions. Seat adjustable for operator comfort. Longer wheelbase and better balance add to riding comfort.

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Unusual accessibility for servicing and maintenance. Battery and oil reservoir are located under an easy-access cover just behind driver's seat. Sealed grease fittings. Exterior hydraulic line outlet provided for easy addition of hydraulically-operated accessories.

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in conjunction with 4-speed, full-reversing transmission provides precise, easy control and the widest possible range of speeds for both forward and reverse. Acts as a shock-absorber for the entire power train.

other features

Closed, pressurized hydraulic system to keep dirt and air out of oil; powerful hydraulic brakes; double-acting hydraulic cylinders and chrome-plated piston rods; 12-volt electric systems on gas-powered models; forward and backup driving lights; tail lights.

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. . . for more details circle 201, page 16

● There is a safe and an unsafe way to handle tractors on steep banks.

to keep the tractors performing at their maximum capacity.

Many of the smaller track-type tractors are equipped with splash lubrication systems for the transmission and bevel gear compartment. When operating on extreme slopes, the top shaft bearings in a transmission do not receive as much lubricant as they would if operating on level ground, and bearing life may be shortened.

When the tractors are to be operated for extended periods of time under these conditions, extra oil should be added to the transmission to extend the bearing life. If extra lubricant is undesirable or is not immediately available, operators should maneuver the tractor sideways momentarily to increase the lubrication. Experience with many machines which literally "stand on end" on mountain sides on logging operations indicates that such sideways maneuvers performed every 500 to 1000 feet

When Your Tractor Works on Steep Slopes

TRACK-type tractors are designed to work in all kinds of terrain and in very adverse conditions. Their tracks allow them maximum traction and flotation in mud, sand and other soft materials. The powerful diesel engines provide plenty of power to allow the tractors to traverse steep grades and rough terrain that are hard for a man to travel on foot. In addition, seals, guards, and other safeguards assure that the track-type tractor can operate under these adverse conditions safely without unnecessary wear and tear on its working parts.

Many times however, unusual operating conditions will require special attention to the transmissions of the machines. Slightly different operating procedures are also necessary measurably extend transmission bearing life.

Track-type tractors that are equipped with force fed lubrication systems in the transmissions will also benefit from added transmission oil or sidewise maneuvers when they are operated down slopes for extended periods of time.

If more attention is given to the tractors that have to be operated under abnormal conditions, the machine operators will add considerably to the life of the tractor. This special care will shorten "down time" and minimize operating costs.

● Only a seasoned operator can be trusted on jobs like this.

Anti-discrimination clause For N. J. contracts

An anti-discrimination clause will be added to all future construction contracts for the Garden State Parkway. This was announced by D. Louis Tonti, acting executive director of the New Jersey Highway Authority.

The move is in connection with the Authority policy of hiring operating personnel on a basis of ability without regard to race, creed or color. A contractor will face annulment of his contract for work on the parkway, if found to be violating any state statute, that prohibits discrimination.

DIGEST of Current Engineering Literature

By JOHN C. BLACK, Associate Editor

Model analysis of a flat slab

Photo-reflective stress analysis, or the "Presan method," is applied to a relatively simple flat plate problem in a Los Angeles building. The basic theory is stated, and procedure under it explained in detail.

The analysis is for one bay of an infinitely continuous slab supported by columns on 20-ft. centers; slab thickness 6¾ in.; ultimate 28-day stress assumed at 3750 psi; live load 50 lb. per sq. ft.

"The Presan method of biaxial stress determination consists of the following procedures:

a. Construction of a model of the basic structure in accordance with the laws of similitude.

b. Loading of the model with scale loads of known magnitude to represent loading conditions of the basic structure.

c. Recording of curvatures of the slab in its loaded condition.

d. Graphical manipulation of curvature values to obtain moments, shears, and deflections of the basic structure.

e. Presentation of final data in a convenient, usable form for design of the structure."

The model here described was of Lucite, machined to an accuracy of 0.001 in. A very thin coating of aluminum provided the reflecting surface. Loadings were applied by compressed air or vacuum on the under side of the slab, with special provisions for irregular loadings. "In its final position, ready for loading, the surface of the model is in a vertical plane and it is so placed in relation to a camera that it reflects onto the camera negative a grid of parallel lines. The camera negative, grid, and model surface are in parallel planes at known distances from each other. . . . Loads applied to the model produce curvature in the reflective surface. These curvatures distort the reflected grid of lines, making them appear at decreased spacing when the slab curves convex to the lens and at increased spacing when the curvature of the slab is concave to the lens."

Principal moments, torsional moments, shears and deflections were determined satisfactorily. The fact that Poisson's ratio is 0.18 for concrete and 0.38 for the model material leads to the only general disagreement between the Presan method and the known, theoretical solutions. Correction of curvature and adjustment of the flexural constant on this account lead to correct final results.

This photo-reflective analysis resulted in an improved disposition and a 17% saving in flexural reinforcement.

To maintain flat slab design in accordance with current developments, seven specific recommendations are made for changes in Chapter 10 of the ACI Building Code.

"Flat Slab Solved by Model Analysis" by Gerald Brown and R. W. Shaffer, President and Vice-President respectively, Presan Corp., Los Angeles, Calif., JOURNAL OF THE AMERICAN CONCRETE INSTITUTE, *18263 W. McNichols Rd., Detroit 19, Mich., Feb., 1955. Price per copy $1.50.*

Soil-cement load-bearing capacities

The table below gives bearing values for soil-cement and other pavements at five airports for which comparative data were available from U. S. government agencies.

Subgrade bearing value	Base-course type	Bearing value—k*
k-125	6-in. soil-cement†	535
k-125	8-in. compacted gravel†	355
k-400	6-in. soil-cement	1012
k-376	5½-in. macadam, 2-in. bituminous surface	626
k-190	6-in. soil-cement, 2-in. bituminous surface	400
k-220	6-in. Emulsion stabilized 2-in. bituminous surface	229
——	6-in. soil-cement	940
——	8-in. sand-clay, bituminous seal	520
CBR-30	6-in. soil-cement, bituminous seal	424
CBR-17	8-in. bituminous stabilized, 2-in. bituminous surface	275

"Recent condition surveys have shown all of these five airports to be in good condition. At all of them, little or no maintenance has been necessary on the soil-cement base. The pavements have carried wheel loads ranging up to about 30,000 lb. for long periods of time without damage.

"These tests confirm the results of bearing tests made in many parts of the United States by various highway and engineering agencies."

"Airport Data Show S/C's Greater Load Capacity," SOIL-CEMENT NEWS, *The Portland Cement Association, 33 W. Grand Ave., Chicago, Ill. December, 1954.*

*Load-bearing tests were performed using various-sized bearing plates. In order to obtain some common basis for comparison at any individual airport, the bearing data were converted to k values for a 30-in. plate at 0.2-in. deflection.

†Subbase for concrete pavement.

Revision of earth pressure theory

The first part of the paper demonstrates that the objection to Coulomb's classical earth-pressure theory (conditions of equilibrium are not fulfilled in case of oblique earth pressure) is only the consequence of an unjustified assumption of linear distribution of stress along the slip plane and the back of the retaining wall. If stresses are correctly assumed, it is only in case of horizontal earth pressure that the point of application of earth pressure is at a third of the height; if there is wall friction acting, i.e., in case of oblique earth pressure, the point of application is above the one-third point of height, as proved by experiments.

The second part of the paper relates to earth pressures on circular structures.

"Some Problems of Earth Pressure," by L. Karafiath. Acta Techn. Hung. Budapest 7, 3-4, 313-339, 1953. Applied Mechanics Review, Vol. 7, No. 10, p. 465, October 1954. HIGHWAY RESEARCH ABSTRACTS, *March 1955.*

Embankments across reservoirs

Wave heights and forces are treated mathematically, and specifications are given for embankment protection. Height determination is based on studies made for the University of California under the direction of C. L. Bretschneider, on relatively small bodies of fresh water. The method has been found dependable. Wind velocity, wind duration, fetch, and depth of water are factors. Formulas are given and a diagram provided for velocities from 5 to 80 mph and fetches from 0.2 mile to 50 miles.

The method developed by Sverdrup and Munk of the Scripps Institution of Oceanography in 1942 for use in the planned invasion of North Africa was for oceanic conditions, and is considered of questionable value when applied to inland waters.

For determination of wave forces on shore structures, reference is made to "Wave Forces on Breakwaters," by Robert T. Hudson, Transactions of the American Society of Civil Engineers, Vol. 118, page 653.

For the size of individual stones necessary to resist wave action, the formula developed by Ramon Iribarran Cavanilles is presented, with the original metric units converted to English.

Report of Committee on Roadway and Ballast, Assignment 6 (b), "Construction and Protection of Roadbed Across Reservoir Areas: Specifications," AMERICAN RAILWAY ENGINEERING ASSOCIATION BULLETIN, *Vol. 56, No. 521, February, 1955, American Railway Engineering Association, 59 East Van Buren St., Chicago 5, Ill.*

Extra air helps Gunite operations

Air quantities above the 365 cu. ft. per min. at 45 lb. pressure specified by the Gunite Contractors Association have been found valuable by Johnson Western Contractors of San Pedro, Calif. "In the old days maybe 350 cfm would have been enough for Gunite work but even then pressure might have been low." The increase from 350 to 450-cfm machines brought improvement, but ten years ago these contractors started using 500-cfm units. Now they have standardized on 600-cfm rotary compressors.

"Operational efficiency" is the big claim. Specifically, they state that they can shoot 30 to 40 more sacks of cement per day with 600 feet than with 500 — a 20% increase in total placement.

"Portable Compressors Speed Guniting," COMPRESSED AIR MAGAZINE, *942 Memorial Parkway, Phillipsburg, N. J., March, 1955.*

Snow and ice forecasts for road crews

Advance weather notices facilitate the mobilization of snow and ice-clearing crews — especially extra or stand-by crews — for prompt action in preventing snow build-up on road surfaces, but without the holding of crews ready for unnecessarily long periods.

An interesting and ingenious system of transmitting such notices in code is used in at least one district in England. The coded "snow warning" is sent direct from the weather observatory to the road superintendent and relayed by him to all other authorities within a radius of 8 miles. The message is then translated and crews are called to headquarters on the basis of indicated needs.

"In this way we are prepared for the snow before it actually falls and men are not left hanging around on the off chance of snow falling, thereby burdening an already expensive item such as snow clearing can be. Snow warnings are preceded by the word 'Snow'. Frost warnings by the word 'Frost', and so on. Then follows a number of five figures, the warning is then built up by taking the first figure and looking up the key under the code marked A, then the next figure is translated from the code marked B, and so on until all five figures have been decoded. Thus 'Snow' 32325 would indicate that a moderate fall of snow is expected, within the next three to six hours, giving possibly up to six inches of snow on the ground, with temperature rising slowly, and followed by a slow thaw except for night frost. Where there is uncertainty an (X) will be inserted in place of the figure."

The author has found the system very helpful, especially at night, in getting out the men in time for most effective action.

"Snow Clearing" by A. H. Bates, Highways Superintendent, Wolverhampton, C. B., CONTRACTORS RECORD AND MUNICIPAL ENGINEERING, *Lennox House, Norfolk St., London, W. C. 2, England, Feb. 2, 1955.*

Radio control for traffic lights

Radio controlled traffic lights are on tap for Chicago's traffic. An electronic system, first of its kind in the world, will be used to control traffic signals in a heavy traffic area just north of Chicago's loop. Initially, the traffic lights will be installed at 13 intersections.

The system features the use of electric tones which are transmitted by FM radio like that widely used by fire and police departments.

The cost of installing conventional means of controlling the traffic signals was prohibitive. After several years of intensive investigation, it was found that radio control would be much-less expensive. In addition, the necessity of laying underground cable with accompanying torn-up streets and inconvenience to traffic is avoided. It is expected that the equipment will be installed and operating by July, 1955.

The radio antenna and transmitter for the new system will be located on top of the Board of Trade Building, the highest point in Chicago. The central control station, which will be located a short distance away in City Hall, will be connected to the transmitter by an existing underground cable.

At predetermined times each day, a master mechanism in the central control station will activate a tone signal. The signal will be carried by the underground cable to the transmitter and broadcast to the lights. In the receiver, at each intersection that the signal is intended to control, will be a corresponding tone switch, or decoder. Each decoder will select the signal designed for its intersection, and ignore those intended for other intersections.

The corresponding tone switch in the traffic-light-control box at the intersection will respond to the received tone signal by changing the program (the length of time of green, yellow, and red) of the traffic light.

In addition to predetermined program changes accomplished automatically, the radio controls can be operated manually. This will allow the programs of the traffic lights to be operated in the most-desirable sequence during abnormal conditions, such as bad weather.

"Radio Control for Chicago Traffic Lights," Public Safety, Vol. 47, No. 1, p. 22, January 1955. HIGHWAY RESEARCH ABSTRACTS, *March 1955.*

Ultimate shear loads on concrete beams

Significant conclusions on cracking loads and ultimate loads on reinforced concrete beams tested in shear were developed in research sponsored by the Reinforced Concrete Research Council.

Following is the synopsis of Part 1 of the report.

"Data are presented on the shear strength of 42 simple beams, 40 without web reinforcement and two with web reinforcement. Tests were carried out in three series with the following variables: (1) percentage of longitudinal and web reinforcement, and method of anchorage; (2) size and percentage of longitudinal reinforcement and strength of concrete; and (3) concrete mixture and method of curing. The size of specimen was different for each of the three series.

"The beams were tested with one or two concentrated loads and all fail-

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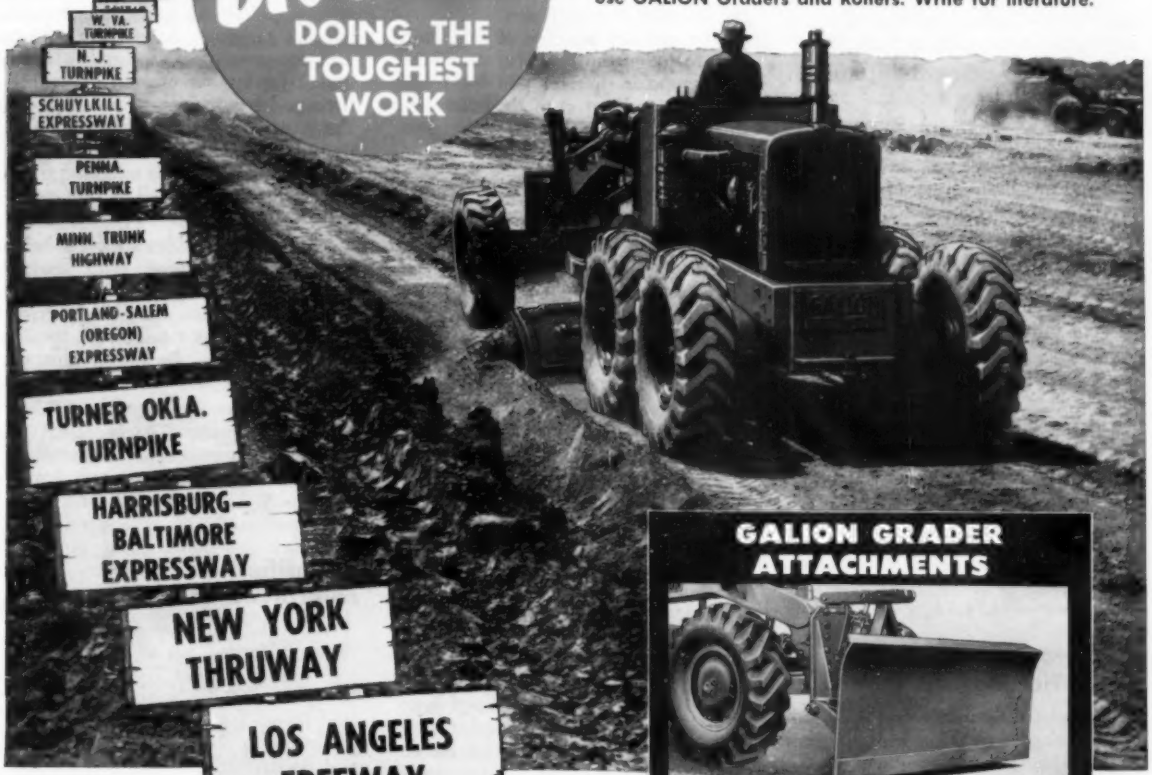

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ed in shear after one or more diagonal tension cracks formed in the region of maximum shear. The magnitude of the loading causing the initial diagonal tension cracks depended primarily on the cross section and the concrete strength. Most beams were able to sustain greater loads than the cracking loads. Magnitude of failure loads depended on cross section dimensions, amount of longitudinal reinforcement, amount of web reinforcement, strength of concrete, and length of shear span. Failure was by destruction of the compression zone of concrete above the diagonal tension crack and adjacent to a loading block.

"Test results indicated that strength of beams with large *a-d* ratios may be governed by the load causing first cracking whereas the strength of shorter beams is governed by the load causing the destruction of the compression zone of concrete. Results also indicate that the load at first cracking may be predicted on the basis of nominal shearing stress and the ultimate load may be predicted on the basis of ultimate moment."

"Shear Strength of Reinforced Concrete Beams, Part 1 — Tests of Simple Beams" by K. G. Moody, I. M. Viest, R. C. Elstner, and E. Hognestad, Members, American Concrete Institute, JOURNAL OF THE AMERICAN CONCRETE INSTITUTE, *18263 W. Nichols Rd., Detroit 19, Mich., December, 1954. (Title No. 51-15 — first of a four-part series — separate prints available at 50 cents each).*

Public opinion surveys in traffic engineering

Highway and traffic officials wishing to learn public opinions or to study public reactions will find pertinent material in this article.

Most important conclusion is that the public — all classes — responds well to a properly presented questionnaire, either oral or written. Scientific polling methods are considered, and two types of question discussed — the "open type," which gives the respondent complete freedom of answer; and the "closed type," in which two or more plausible answers are presented, from which the respondent is asked to select one. In general the closed type is favored as speeding and facilitating answers and simplifying final tabulation, but the value of free comment is recognized and asked for under appropriate conditions. In a study here reported, results were tabulated by means of IBM mark-sensing cards. Experimental questionnaires made possible both improved forms and more effective presentation to motorists.

Truck stops and tourist courts were selected as trial polling points, the operators acting as field agents. The truck stops proved highly successful, the tourist courts not so. Several companies with large vehicle fleets and others with numerous traveling salesmen cooperated effectively.

Results of pollings on proper speed limits and most desirable types of center line markings are shown in considerable detail — the latter varying widely from established engineering practice in most states.

The primary purpose of this study was to judge the practical usefulness of a popular opinion poll on traffic problems and to test methods for conducting it, rather than to obtain specific information.

Among conclusions reached — definite and tentative — the following may be noted:

"The motor vehicle operator is willing to give time to express opinions on certain highway traffic practices. This is evidenced by the ready cooperation obtained wherever the survey forms were distributed to the respondents, the oral and written comments of the respondents, and the very small number of respondents who failed to answer the questions seriously."

"It is generally conceded that the average driver not only considers himself as a highway expert, he is also a traffic expert and a very well qualified one at that. Thus it is very important that all classes of drivers be given an opportunity to answer any survey questions for their answers are naturally influenced by their particular activities. How each class of driver can be adequately sampled is a problem that must be solved before the traffic engineer can begin to apply opinion polling techniques as one of his tools."

"Many authorities in the fields of highway and traffic engineering have agreed that there might at least be limited applications of public opinion surveying techniques to traffic engineering. However a few appeared to be of the opinion that the public doesn't know what they want nor what is good for them so why bother with them." A bibliography of 24 references closes the article.

"Public Opinion Survey Methods as Related to Certain Phases of Traffic Engineering," by John E. Baerwald, Research Engineer, Joint Highway Research Project, Purdue University, Lafayette, Indiana. TRAFFIC ENGINEERING, *Institute of Traffic Engineers, Strathcona Hall, New Haven 11, Conn., January, 1954.*

Glued laminated lumber specifications and data

This progress report on an association committee assignment includes seven pages of descriptive specifications and eight pages of tables.

The descriptions cover the material as manufactured, and certain details of design, fabrication, and construction. Formulas for curvature factor and radial tension or compression are included.

The tables give allowable unit stresses (extreme fiber in bending, tension parallel to grain, compression parallel to grain, longitudinal shear, and compression perpendicular to grain) for lumber of 4 to 14 laminations and for 15 laminations or more. For hardwoods, the modulus of elasticity is included. The data cover normal loading conditions and long duration of loading, as well as dry conditions of use and wet conditions of use.

The softwood tables are for douglas fir and southern pine, with laminations of various specified lumber grades. Tables of hardwoods cover ten major groups totalling 21 species and sub-species. Permitted steepest slopes of grain and scarf are given.

"Specifications for Structural Glued Laminated Lumber," AMERICAN RAILWAY ENGINEERING ASSOCIATION BULLETIN, *59 East Van Buren Street, Chicago 5, Ill., January, 1954.*

Simplified design of reinforced concrete

The principal purpose of concrete research carried out at Imperial College during the last 7 years has been to try to establish a general ultimate load theory for improvement and simplification in the design of reinforced and prestressed concrete frameworks. Present methods of design are based partly on ultimate load conditions.

The plastic-hinge theory enables complex frameworks to be designed to have an economic distribution of bending moments at failure and a uniform factor of safety. Calculations for many types of frame used in practice may be reduced to the application of simple formulas. Further economies may be made in many structures by the use of smaller concrete sections of high-grade concrete.

In spite of the variable nature of deformations in concrete prior to failure, the plastic-hinge theory enables bending moment distributions in framework to be calculated with sufficient accuracy for practical design.

The theory prepares the way for establishing simple bending moment formulas for vertical and horizontal

loading in many kinds of framework within a wide range of stiffness ratios.

The approximate bending moments in a framework for the elastic condition may be quickly found by trial and adjustment, using the same influence coefficients required for hinge rotation values in the plastic condition. The use of special binding greatly increases available strains in plastic zones. Deformation calculations are necessary to establish stiffness ratio limits.

The position of the neutral axis in framework members is governed mainly by strain values at the extremities of the sections. Variations due to bond conditions are small and conveniently expressed by the factor F. In nonbonded beams the factor F, however, has very low values, indicating that it is important to carry out effective grouting.

Bending moment values for concrete may be calculated from the formula Qbd^2C_u with suitable adaptations for T and I beams. Q generally equals 0.2 for reinforced concrete or for prestressed-concrete beams having adequate prestress and bond.

Considerable economy could be made in the design of many structures by using high-grade concrete and basing ultimate load calculations on values of C_u of, say, 4,500 psi. when the mean value of a small number of preliminary cube tests is 6,000 psi. or in special cases higher strengths. It should be pointed out that the strength variation on most sites at present is probably over 2,000 psi., but this could be reduced to 1,500 psi. or 1,000 psi. in special cases. In the future, when sufficient test results have been obtained for statistical examination, it may be possible to show that the safe limiting values of e'_c and xc' and C_u are so unlikely to occur simultaneously that the value of Q may without risk be increased to 0.25, or even higher, for the low values of n_1 or C_u. A factor of safety of 2 would be used in the calculations so that provided the standard of quality control in the field was such that in the structure no concrete was used at critical sections weaker than 4,500 psi., the actual factor safety in regard to the concrete would be the same as for the steel, i.e. about 2, which is generally considered adequate.

The use of deformed bars enables higher working stresses to be used because of the reduction in crack width. Approximately, deformed bars develop similar crackswidths to plain bars of similar diameter at 1½ times the stress. However, the better bond does not greatly influence the position of the neutral axis which is governed by the strain, so that deformed bars at high stress have smaller values of n_1 compared with plain bars of similar diameter at low stress; n_1 may be found from the strains at the extremities of the section. The value of F is only very slightly higher than for plain bars.

"Recent Research at Imperial College on the Design of Reinforced Concrete Frameworks by Ultimate Load Theory," by A. L. L. Baker. THE REINFORCED CONCRETE REVIEW *(England), Vol. 3, No. 6, pp. 313-370, 1954.* HIGHWAY RESEARCH ABSTRACTS, *March 1955.*

Stresses in sheet pile walls

The variation of the maximum bending moment on sheet-pile walls with pile flexibility and soil stiffness is calculated for the cases of cantilevered piling and anchored piling, assuming a modulus of subgrade reaction which increases linearly with depth. The mathematics is too involved for direct design office use, but a final "master" moment-flexibility curve is calculated which is of universal application.

The value of the modulus of the soil is estimated from theory and simple stiff-wall tests, and results in good agreement between the theory and observations on model sheet-pile walls. The influence of seepage forces and more-compressible subsoils than loose sand on the stability of sheet-piling is then readily estimated from observations on their influence on the soil modulus.

"A Theoretical and Experimental Analysis of Sheet-Pile Walls" by Peter Walter Rowe. PROCEEDINGS, *Institution of Civil Engineers (England), Vol. 4, No. 1, Pt. 1, Paper No. 5989, pp. 32-69, January 1955.* HIGHWAY RESEARCH ABSTRACTS, *March 1955.*

Thawing agents and the scaling of concrete

This report is a resume to date of investigations started in 1948 to test materials and procedures for producing concrete with increased resistance to the scaling action and disintegration caused by calcium chloride and other ice-removing agents, and for protecting finished pavements against such action. Both laboratory and outdoor exposure tests are covered.

Principal conclusions from laboratory (artificial freezing) tests:

1. An entrained air content above 6% was more effective than an increase of cement in preventing scaling.

2. Mineral oil applied to cured and seasoned concrete increased the resistance to calcium chloride, but oil on freshly placed concrete decreased resistance to scaling.

3. Neither paraffin nor asphaltic base oils used as admixtures were of much value in controlling scale. Admixtures of used crankcase oil retarded the start of scaling because of the air they entrained.

4. Urea was slower in thawing action than calcium chloride. It caused scaling but not so quickly as $CaCl_2$. varying the amount of either urea or calcium chloride had little effect on the start or the rate of progress of scaling action.

5. Vacuum treatment of plastic, 6- or 7-sack concrete, either plain or air-entrained, increased scaling resistance.

Principal conclusions from the outdoor tests:

1. All air-entraining admixtures tested were effective in delaying the start of serious scaling. An air content of more than 5% improves the resistance of concrete made with 1-in. maximum size aggregate.

2. Scaling was less pronounced in samples cast in molds with a sand base than in those with a metal base, due to lower water retention in the former.

3. Cement with a low alkali content made a more resistant concrete than cement with relatively high alkali.

4. Fly ash in the concrete mix lowered resistance to scaling, even when entrained air was maintained at specification limit.

5. Type of curing had little apparent effect on resistance to calcium chloride. Membrane curing had some protective action so long as the film remained unbroken, but is believed to be of little or no value under traffic conditions.

6. Vacuum treatment did not materially improve concrete cast in molds with metal bases, but increased the resistance of samples cast on sand bases. This relationship held for air contents ranging from 1% to 10%.

This study was made by the Physical Research Branch of the Bureau of Public Roads. The 15-page report contains many illustrations of samples, tables and diagrams.

"Factors Affecting Resistance of Portland Cement Concrete to Scaling Action of Thawing Agents," reported by Albert G. Timms, Supervising Highway Physical Research Engineer, PUBLIC ROADS, *April, 1955. Obtainable from the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Price 20 cents per copy.*

Job and Safety Management School For Contractors' Men

Foremen and operators in this unique Michigan short course get preseason briefing on safety, handling of men and machines, and other subjects

HIGHWAY contractors in Michigan are sending their job superintendents back to the little red schoolhouse. Believing that their top project men can help them to cut costs through management training, the roadbuilders are investing in higher education. And the tough construction foremen, some of whom are seeing the inside of a classroom for the first time in 30 years, love it.

The only school of its kind for road contractors' personnel, the unique course of instruction at Michigan State College is a joint project of the college and the Michigan Road Builders' Association. Since the idea was launched in 1953-54 winter, some 175 men have enrolled for a week-long period of practical study into job management problems. Three classes were held the first winter during the slack season and three classes were conducted again this past winter.

The curriculum is as realistic as possible inside a classroom. It includes such subjects as handling men, orientation of new workers, training of equipment operators, equipment maintenance, oral and written communication, safety prevention, traffic control and first aid.

Michigan State College provides classroom facilities, instructors and teaching equipment at a nominal cost under the Continuing Education Service, a special adult training department. Instructors are usually specialists brought in from various fields. For example, a traffic consultant in police administration teaches traffic control techniques and an insurance man with considerable experience in the construction industry gives instruction in accident prevention.

Bernard I. Loft, director of the special course, has proved to be an inspiring instructor. C. J. "Irish" Carroll, executive secretary of the roadbuilders' association, gives him credit for much of the popularity of the class.

"He talks to these guys in the vocabulary of the job," Mr. Carroll said. "Furthermore, the course improves each time because the instructors prod our men for practical suggestions, and they take our advice seriously."

A contractor may send as many superintendents to the school as he wishes. One firm has sent 12 employees thus far. It pays their expenses, room and board for the week-long stay in Lansing. This usually runs to about $75.

The association sponsors and publicizes the program, helps line up the men, acts as liaison with the college, and pays the registration fee of $37 for the first man from any contracting firm to enroll. What do the highway contractors think of the program? "They're all for it," Mr. Carroll declares. "They *must* be! They're footing the bill."

The 175 job superintendents who have finished the class are enthusiastic. They feel that the instruction has made them more capable on the project and that they are now better prepared to increase efficiency. Their educational backgrounds vary from grade school to college. The week away from the job routine is refreshing in itself, but no vacation. They are scheduled for 40 hours of classroom work, besides evening assignments. The original program called for 40 hours of instruction only, but the men themselves have since appealed for more training in first aid and accident prevention.

In discussing job management problems, the emphasis is upon "student" participation. The men are encouraged to contribute from their own on-the-job experiences and to ask

● **Bernard I. Loft, Course Director, who is Assistant Professor Continuing Education Service, Michigan State College, lecturing on "A Safety Program For Your Company."**

- (Left across): Demonstration of artificial resuscitation. Volunteer victim is David Krogh of Rieth-Riley Construction Co., Battle Creek, Mich.; administering resuscitation is Charles Allen of Cross & White, Grand Rapids, Mich.; in back row: John LaBeske and Chester Gibbs, Thorton Construction Co., Hancock, Mich.; Dennis F. Haley, safety supervisor, Michigan State Highway Dept.; R. G. Harvie, W. H. Harvie Inc., Detroit; Leon Fleming, Harry Pickitt Co., Allegan, Mich.; Edmond Loselle, Loselle Construction Co., Wyandotte, Mich.; Paul Brenneman, L. A. Davidson Co., Lansing; and Frank Poquette, Hodgkiss & Douma, Petoskey, Mich.

- (Right across): A practical demonstration of fire fighting equipment. Onlookers are Jack Hunt of Sugden & Sivier, Oak Park, Mich.; Fred Thomas, Denton Construction Co., Grosse Pointe Woods, Mich.; Richard Bernitt of Michigan State College.

questions frequently. Every modern educational technique, including "group dynamics" is employed to stimulate full participation.

One graduate of the course, who was particularly impressed by the safety discussions, told his contractor-employer, "This is something I would have hated to miss. Just for example, before the accident prevention instruction, I had never known that the two-way radio in my car could set off the electric blasting caps I carry."

Another practical result was reported by a Michigan physician. An accident on the project of Sugden & Sivier, Inc., left an employee bleeding badly with a severed artery. No one knew what to do for him. But the job supervisor, followed instructions he had learned in the Michigan State College class, applied a tourniquet of form wire. When the resident physician received the patient at his hospital shortly thereafter, he said:

"I don't know whose idea this was, but whoever applied that wire tourniquet saved this man's life."

Harry Kirk, a former highway director in Ohio, now research and safety director for the Associated General Contractors of America in Washington, D. C. has watched the Michigan experiment with enthusiasm.

"Frankly, I'm impressed by what the Michigan roadbuilders are doing," he said. "This is comparatively new stuff for the construction industry. As far as I know, this is the first instance in the highway field. It's a real morale builder for the men, and the contractor is bound to benefit from what they are learning. They are turning supervisors into better men out there."

Court Decisions That Affect Jobs

By William Hurd Hillyer

Dust-raising held necessary part of job

Right of road construction to be dusty was upheld by Court of Appeals of Kentucky, reversing lower court's decision. A couple of tobacco planters who had deeded part of their land for highway purposes sued the Commonwealth to recover damages caused, they said, by settlement of road-improvement dust on their respective crops.

The higher tribunal held that the damage was of a consequential nature incident to a prudent and proper exercise of rights acquired by the Commonwealth along with the land. The court could see no substantial difference between dust raised by ordinary traffic on a highway and the movement of bulldozers correctly used in its construction or repair.

To the tobacco planters' contention that they did not anticipate such crop damage when they parted with some of their acreage, the learned Commissioner reminded them, with citations, that when property is appropriated for public use the landowner's just compensation embraces resultant damage to his remaining land, "including covering it with debris."

Commonwealth et al vs. Moore et al, Court of Appeals of Kentucky Ky., 267 S W 531.

Independent contractors must coordinate work

Texas courts recently reminded a grading concern, to the tune of several thousand dollars, that due regard for a fellow-contractor's work and interest is required under the law.

A real estate owner made separate agreements with grading contractor and electrical contractor for the construction of a drive-in theatre on his property. American Institute of Architects' Standard Form of Subcontract with named architect was used in each instance.

On the job the theatre man assumed the position of both owner and general contractor, treating the electrician as subcontractor on all electrical work and the grader as subcontractor on all grading, ramps, etc.,

according to specifications and blueprints attached to contract.

The electrical contractor sued the grading contractor for damages amounting to $5,500 plus $2,000 attorney's fees, claiming that the grader's grading machine had negligently cut back and destroyed 5,700 feet of wire which the electrician had laid under the street according to his contract. The jury found in favor of the electrical contractor to the extent of $3,085, and the grader appealed.

He claimed, among other things, that (1) he owed the electrician no duty to prepare the sub-grade or asphalt surface in any particular manner; (2) that there was no contractual relationship between him and the electrician for the performance of their respective portions of the work; (3) that there were no obligations whatsoever between them. The electrical contractor countered that, regardless of any contract, the grader owed him the duty not to destroy his electrical work.

After reviewing the case in detail, the Court of Civil Appeals ruled that the theatrical proprietor stood in the legal position of owner — not general contractor — and that the two contractors were independent original contractors — not subcontractors — who were bound to coordinate their work so as not to injure each other.

The higher court held that the grading contractor, through breach of this duty, in that he had destroyed the wires by use of a grading machine, was liable to the electrical contractor for damages. The trial court's judgment was affirmed to the extent of $3,585 including attorney's fees.

Southwest General Construction Co. vs. Price Court of Civil Appeals of Texas, 267 S. W. 2d 855.

●

Expressway tested in court

Three judges of the Western Maryland Judicial Circuit have upheld the demurrer filed by the City of Cumberland, concerning a taxpayer's suit to invalidate the contract with the State Roads Commission for constructing a $10,000,000 expressway through Cumberland. It was held that Cumberland's City Council was within its authority granted by the City Charter when it made the agreement with the State. The judges declined to consider the merits of the projected expressway, pointing out that courts should not attempt to substitute their judgments for that of administrative officials.

The Art of Getting Along

(As reproduced in "Texas Highways," published by the Texas Highway Department for its employees.)

SOONER or later, a man, if he is wise, discovers that business life is a mixture of good days and bad, victory and defeat, give and take.

He learns that it doesn't pay to be a sensitive soul — that he should let some things go over his head like water off a duck's back.

He learns that he who loses his temper usually loses.

He learns that all men have burnt toast for breakfast now and then and that he shouldn't take the other fellow's grouch too seriously.

He learns that carrying a chip on his shoulder is the easiest way to get into a fight.

He learns that the quickest way to become unpopular is to carry tales and gossip about others.

He learns that it doesn't matter so much who gets the credit so long as the business shows a profit.

He learns that buck-passing always turns out to be a boomerang and that it never pays.

He comes to realize that his business could run along perfectly well without him.

He learns that it doesn't do any harm to smile and say "Goodmorning" even if it is raining.

He learns that most of the other fellows are as ambitious as he is, that they have brains that are as good or better and that hard work and not cleverness is the secret of success.

He learns to sympathize with the youngster coming into the business, because he remembers how bewildered he was when he first started out.

He learns not to worry when he makes a mistake, because experience has shown that if he always gives his best his average will break pretty well.

He learns that no man ever gets to first base alone and that it is only through cooperative effort that we move on to better things.

He learns that bosses are not monsters trying to get the last ounce of work out of him for the least amount of pay, but are usually fine men who have succeeded through hard work and want to do the right thing.

He learns that the folks are not any harder to get along with in one place than another and that "getting along" depends about 98% on his own behavior.

Pre-fab buildings solve housing problem for Montreal city equipment

The quonset buildings shown are among the six Wonder-manufactured steel buildings furnished to the city of Montreal recently. These all steel prefabricated units, erected within a few hours, are used to house the large equipment fleet, that clears Montreal's streets of ice and snow and also spreads salt.

The buildings are 60x110 ft. They were chosen for equipment storage as being of special value for off-season storage due to being weatherproof and for the absence of pillars or trusses, which would break up the floor space.

● Showing two of the six Wonder steel pre-fabricated buildings used by the city of Montreal for housing salt and plow equipment.

Health Hazards in Tunnel Construction

By George L. Wilson, B.S., and Harvey J. Roberts, B.S.

THE West Virginia Turnpike is being built as a toll road across West Virginia by the West Virginia Turnpike Commission, an organization set up by an act of the state legislature. The Commission employed the consulting engineering firm of Howard, Needles, Tammen and Bergendoff, 55 Liberty Street, New York, as the general engineering supervisor of all construction. This firm also acted as engineer on the tunnel construction with which we are presently concerned. The contractor was Bates and Rogers Construction Corporation, Chicago, and the design engineers were Singstad and Baillie, Consulting Engineers, New York. The tunnel, built as part of the turnpike, is located in Kanawha County, with the south portal near the town of Standard. The excavation was made from the south portal; it is approximately 35 ft. wide, 33 ft. high, and 2,665 ft. in length. About 100,000 cu. yd. of rock was removed. The finished tunnel will be in the form of a semicircular arch with straight sidewalls, providing for a roadway 24 ft. wide.

Contract Provisions

1. The contract specified the maximum concentration of hazardous gases allowable in the tunnel atmosphere, and they were as follows: methane, 0.5%; carbon monoxide, 0.1%; carbon dioxide, 0.1%; oxides of nitrogen, 0.0025%; hydrogen sulfide, 0.002%, and sulfur dioxide, 0.001%. It was also specified that the oxygen content should not fall below 14%.

2. The contract specified that the concentration of free silica dust in the tunnel atmosphere during construction was not to exceed 5,000,000 particles per cubic foot (ppcf) of air and required wet drilling and continuous wetting down of the muck pile during mucking operations.

3. A ventilation plant with a minimum capacity of 20,000 c.f.m. was required. This system was operated around the clock six working days a week and for at least two hours prior to resumption of work on Monday. In addition, the fire boss checked the air for explosive gases before any one else entered the tunnel on Monday morning and routinely during the time that the tunnel was occupied.

4. A preemployment physical examination was required. Applicants showing evidence of silicossis and those who, in the judgement of the examining physician, had any pulmonary condition which would be aggravated by the environmental conditions in the tunnel were rejected.

5. The contractor was required to have a qualified professional engineer to act as safety engineer.

6. The contractor was required to employ on each shift a fire boss certified by the West Virginia State Department of Mines. He checked routinely for methane, carbon monoxide, and oxygen deficiency and also acted as a general safety inspector.

7. The contractor was required to carry workmen's compensation insurance with the West Virginia Workmen's Compensation Commission.

Role of Health Department

Throughout the period of time that the tunnel was being driven, the Bureau of Industrial Hygiene, West Virginia State Department of Health, made routine checks of the atmosphere in the tunnel. Samples were taken once each week from May 25 until September 30, 1953. Samples were taken each week for dust counting, free silica analysis, carbon monoxide, oxides of nitrogen, and aldehydes. Samples were taken occasionally for sulfur dioxide, hydrogen sulfide, oxygen, and carbon dioxide. Aldehydes were checked, inasmuch as diesel-powered equipment was used underground.

Test drilling indicated a high free silica content in the rock to be removed, and this proved to be the case. The rock was primarily sandstone, with an intermixture of small amounts of mica, silica-bearing shale, and occasional narrow seams of coal.

1. Drilling. Drilling was done from the conventional platform ("jumbo") used in tunneling operations. Mounted on the "jumbo" were a total of 13 drifter-type pneumatic drills on four levels. The holes drilled ranged from 1⅝ to 2⅜ in. in diameter, and at different times the depth drilled ranged from 7 to 13 ft. Each drill required about ½ gal. per min. of water On the average, about 128 full-length and 29 half-length "plug" holes were drilled on each round. Drilling required from two and one-half to three and one-half hours on each round, depending on the depth of holes drilled.

2. Shooting. As soon as drilling was completed, the holes were loaded (about 2.8 lb. of 40% dynamite per cubic yard of rock shot down), the "jumbo" was moved back about 125 ft., all workmen were moved to the outside, and the shot was fired. Depending on the depth drilled, from 235 to 415 cu. yd. of rock was shot down. The shot produced rock (or muck) of a size convenient for handling by a 2 cu. yd. capacity diesel shovel. The muck was relatively free of fines.

3. Mucking. About one-half hour after the shot the foreman and the fire boss proceeded to the heading to make an inspection; then mucking started. A bulldozer was used to clean up muck thrown away from the heading by the blast, and a 2 cu. yd. diesel shovel loaded the muck into diesel-powered LeTourneau "Tournarockers," which removed it to the outside for disposal. Three to four "Tournarockers" were used in hauling muck.

After mucking was finished, the "jumbo" was towed to the heading, steel roof supports set, and the cycle repeated. The length of cycles varied from about 8 to 15 hours, again depending on the depth of the holes drilled and consequently the amount of rock blasted down. Average proggress in driving the tunnel was about 20 ft. a day, six days each week.

There were ordinarily about 30 to 35 men at or near the heading during most of each shift; during the day shift there were a few more than that, including those there part of the time, such as electricians, laborers extending ventilation pipe, water and air lines, etc. On the average, drilling took about one-fourth and mucking one-third of the eight-hour shift. The

Editor's Note: The control of air conditions against contamination is a vital construction problem in almost every tunnel project. This was especially true for a tunnel recently completed for the West Virginia Turnpike. An exceptional report of safeguards established and maintained for the tunnel construction personnel on this project appeared in the AMA Archives of Industrial Hygiene and Occupational Medicine, August, 1954; Vol. 10, pp. 142-151. Because it is one of the most complete and authoritative articles every published on this subject, ROADS AND STREETS presents the full report with minor editorial abridgements in order to give the dissemination it merits to heavy construction and engineering personnel.

The authors Mr. Wilson and Mr. Roberts, are the Associate Director and Assistant Industrial Hygenist, respectifully, Bureau of Industrial Hygiene, Virginia State Department of Health, Charleston.

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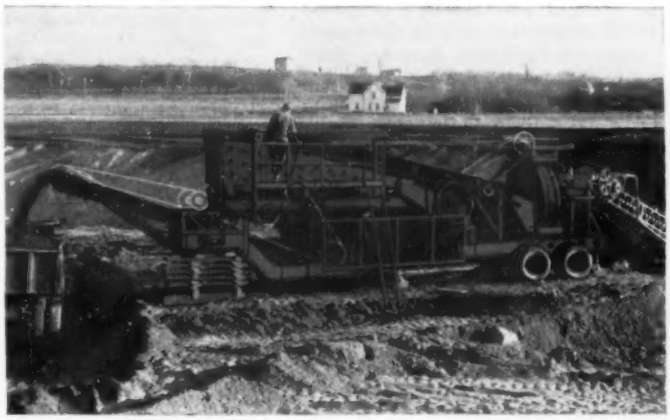

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. . . for more details circle 244, page 16

● Cleaning muck at heading with 2-yd. diesel shovel loading into LeTourneau Tournarocker. Average progress 20-ft. per day. About 100,000 cu. yd. for whole job.

balance of the shift was spent on work which caused little or no air contamination.

Initially a No. 2 fuel was used in the diesel equipment which operated underground. The concentration of exhaust products resulted in some eye irritation described by different observers as slight to moderate. As a result, the Bureau suggested that underground equipment be operated on No. 1 fuel. This change was made, and thereafter eye irritation was seldom noticed.

Dynamite Used

The dynamite used initially was a "redipped" type. About half way through the job a change was made to a "sprayed" type. There appeared to be less fume produced by the "sprayed" dynamite, although as the tunnel progressed there was increased time for fumes to become diluted with the air delivered to the heading before being exhausted to the outside. In addition, a smaller shot was employed during the latter period; thus less fume was produced. There was much less paraffin on the "sprayed" type to add to the fumes resulting from the dynamite itself. All dynamite was a type acceptable for underground use.

Ventilation System

The ventilation system was installed with the blower and motor outside, near the portal, with a 26 in. diameter steel tube delivering the air to the heading. The outlet of the tube was kept as close to the heading as possible without being damaged by blasting. Ordinarily it was about 120 ft. from the heading. The velocity of the air as it left the pipe was sufficient to sweep around the heading and thus remove dust and fumes. In other words, there was no "dead space" at the heading.

Immediately after shooting, air was exhausted from the heading in order to remove the worst of the fumes and dust. Then, after several minutes, the flow of air was reversed, and fresh air was delivered to the heading until time for the next shot.

Operation of drills supplied about 3,000 c.f.m. of air to the heading during the time they were in operation. This was in addition to that supplied by the ventilation system.

Analytical Results

The total number of samples taken for various contaminants was as follows: dust counts 143; free silica analysis 34, carbon monoxide 49; oxides of nitrogen 78; oxygen and carbon dioxide 34; sulfur dioxide 18, hydrogen sulfide 5; aldehydes 64, and partially burned fuel 7.

1. Dust and Free Silica During Mucking Operations. During mucking operations samples for dust counting were usually taken (1) at the heading ahead of the mucking shovel, (2) just behind the mucking shovel, (3) on the bottom near the "jumbo," and (4) on top of the "jumbo." These were the areas where the most workers were ordinarily located. The samples taken at the "jumbo" location (usually about 125 ft. from actual mucking operations) showed no significant difference from those taken near the shovel, and there was ordinarily no significance difference between those taken on top of the "jumbo" and those taken on the bottom near the "jumbo." This indicates that the dust produced in mucking operations was rapidly dispersed throughout all available space.

The lowest dust count was 4,500,000 ppcf, while the highest count was 32,000,000 ppcf. Ordinarily the average amount of dust varied from 8,000,000 to 17,000,000 ppcf. The single high count of 32,000,000 ppcf was found at a time when the water was not being properly used on the muck pile.

During mucking operations samples of air-borne dust were taken with the Staplex air sampler fitted with the conventional pleated type TFA-S filter. These samples were analyzed for free silica. The percentage of free silica found was relatively constant, varying from a low of 25% to a high of 37% and averaging about 31%. It is interesting to note that the free silica content of the air-borne dust was considerably lower than that of the rock itself. Several analyses were made on samples of the rock, and the free silica content proved to be relatively constant, averaging about 54%.

Vehicular activity in the tunnel caused no dust, as the bottom was wet at all times while the tunnel was being driven. This was due to the large quantity of water used at the heading.

2. Dust and Free Silica During Drilling Operations. During drilling operations samples were also taken for dust counting, again accompanied by collection of airborne dust for free silica determination. Samples were taken in the breathing zone of drillers and helpers at various locations on the "jumbo." Dust counts ran from 1,000,000 to about 6,000,000 ppcf and averaged about 3,000,000 ppcf. The free silica content of this dust was the same as that collected during mucking, averaging about 31%.

3. Carbon Monoxide. Carbon mon-

oxide was checked with the M. S. A. colorimetric detector. The fire boss also made routine checks with the same type of instrument.

Sources of CO were from dynamite, diesel motors, and gasoline-powered trucks which were used in maintenance and supply operations. The gasoline-powered trucks were not too important a factor, owing to the limited time they were in the tunnel. The fire boss regularly took a CO sample when he reached the heading for his inspection after blasting. The amount normally found was in the range from none to 50 ppm parts of air. We also occasionally entered the tunnel with the fire boss, and our sampling confirmed his results. There was, of course, a large quantity of carbon monoxide produced from the dynamite, but the ventilation air diluted it considerably. The highest reading obtained in what appeared to be the worst of the blasting fume was 200 ppm. The highest concentration found soon passed any one point in tunnel. Within one-half hour after the highest amount was found (200 ppm in this case), the concentration had dropped to 50 ppm and one-half hour later to less than 25 ppm.

It should be remembered throughout this period muck-hauling vehicles were operating; yet by 2:18 p.m. (approximately two hours after the shot) the carbon monoxide concentration was very low. This rapid fall in the CO concentration was typical of other series of measurements made in the same manner and indicates that the quantity of CO present in the diesel exhaust was of little or no hygienic significance after dilution with the air supplied by the ventilation system.

4. Oxides of Nitrogen. There were two possible sources of oxides of nitrogen: (1) dynamite fumes and (2) diesel engines. Samples were taken in what appeared to be the worst of the fume from blasting and at various locations throughout the time that mucking was in progress.

The concentration pattern for oxides of nitrogen was similar to that found for carbon monoxide: The highest concentrations were found in the fume from the dynamite and as the fume passed a particular point the concentration fell rapidly to 4 to 8 ppm.

At times when fumes from dynamite were not present but during the time that mucking progressed, the concentration of oxides of nitrogen was usually in the range 4 to 8 ppm.

Occasional samples taken at times when there were no dynamite or diesel fumes gave negative results.

5. Carbon and Carbon Dioxide. Oxygen content of the air, as measured at points throughout the tunnel, never fell appreciably, usually being 20.7 to 20.8%. Carbon dioxide seldom exceeded 0.1% and was usually less than 0.1%.

6. Aldehydes. Since aldehydes are produced in diesel engines in the combustion process, samples for aldehyde determination were taken while mucking was in progress. Results are expressed as equivalent parts per million of formaldehyde. The concentration of aldehydes usually did not vary appreciably at different sampling locations. In as much as aldehyde samples were taken as approximately the same time as those for carbon monoxide and oxides of nitrogen, many were taken in the blasting fume. No general decrease in aldehyde concentration occurred after this fume passed, as was the case with carbon monoxide and oxides of nitrogen, indicating that diesel fumes were the primary source of aldehydes. The concentration of aldehydes from the diesel engines was about 0.6 to 0.8 ppm.

Samples were taken occasionally when no diesels were operating, and aldehydes were not detected.

7. Sulfur Dioxide. The sulfur content of the diesel fuel was known to be very low, and significant amounts of sulfur dioxide were not expected. The samples taken confirmed that sulfur dioxide was not present in quantities of hygienic significance.

8. Hydrogen Sulfide. The possibility of the presence of hydrogen sulfide was recognized because of the action of water on coal containing sulfides. However, none was detected with the use of the M. S. A. Hydrogen Sulfide Detector, nor was the odor of hydrogen sulfide ever noticed.

Conclusions

1. Wet drilling, generous use of water during mucking, and the ventilation system used kept the dust concentration within acceptable limits.

2. The ventilation system was adequate for dilution and removal of fumes and gases from shooting and oxides of nitrogen diesel engines, but at times it was inadequate for removal of unburned and partially burned fuel.

3. Carbon monoxide from diesel engines was not present in the tunnel atmosphere in significant amounts.

4. The oxygen content of the air in the tunnel was adequate; carbon dioxide was not a problem.

5. Sulfur dioxide (from the fuel) was not encountered in significant amounts.

6. Methane and hydrogen sulfide were not detected.

7. The eye irritation is believed to have been due to unburned or partially burned fuel, although low concentrations of aldehydes may have been a factor.

8. There is probably less fume produced from the "sprayed" than from the "redipped" dynamite.

9. The noise level was probably high enough to be damaging after an exposure period of several years.

Some Recommendations for Tunneling Operations

1. Contract Provisions. Provisions in contracts covering health and welfare should be spelled out in detail, as was done here. In this way the contractor knows prior to the undertaking just what standards are to be met.

2. Control of Dust. (a) Wet drilling and continuous wetting of muck are necessary. (b) Production of a large quantity of fines in the muck caused by shooting should be avoided.

3. Ventilation. If diesel-powered equipment is to be used safely in confined areas, the calculations for ventilation must take this into consideration. One method of calculation recommends that the minimum ventilation air supplied where diesels are used in confined areas should be 25 to 50 times the piston displacement at maximum rated speed. On the basis of our experience, this is a sound recommendation.

4. Operation of Diesel Equipment in Confined Areas. (a) No. 1 fuel oil should be used, as low-boiling fuels vaporize more readily and burn more completely. (b) Equipment must be maintained in good mechanical condition, and air-filter equipment must receive special attention where dust is present, as satisfactory combustion is attainable only when uncontaminated air is introduced into the engine. (c) Injectors should be adjusted so combustion takes place in excess air, and the air/fuel ratio should be 20 to 1, or leaner. (d) The operator should take the throttle up gradually after an idling period in order to burn the excess fuel in the combustion chamber with excess air.

5. Explosives. Explosives should be a type approved for underground use. "Sprayed" dynamite should be used.

Acknowledgments

Mr. Paul D. Halley, Industrial Hygienist, Standard Oil Company of Indiana, Chicago, formerly Associate Director of this Bureau, and Mr. E. V. Jones, Resident Engineer, Howard, Needles, Tammen & Bergendoff, offered many helpful suggestions during the course of this work and critically reviewed the manuscript.

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NEW Torque Converter Drive . . . smooth, powerful
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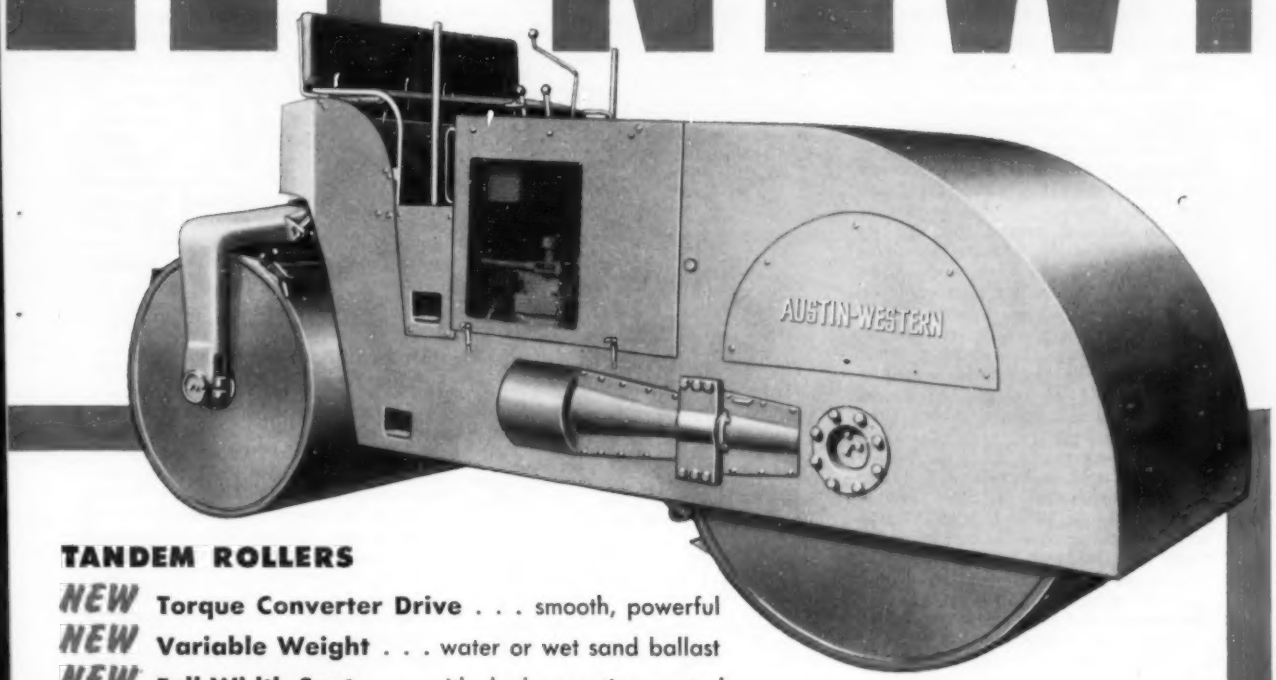

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While the Torque Converter Drive described on the opposite page is probably their most important feature, this new line of tandem rollers incorporates many other refinements designed to provide exceptionally smooth performance on precision jobs. Modern industrial engines furnish a smooth flow of steady power; uniform weight distribution eliminates side sway; effortless hydraulic power is used for steering . . . such features are your assurance of dependable, low-cost service. Available in 5-8, 8-12 and 10-14 ton sizes.

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What's New
in Equipment and Materials

(See Page 16 for Reader Service Coupon, more items pages 148-157)

Gasoline Concrete Vibrator

A new heavy duty gasoline concrete vibrator, Model A.G., has been put on the market by Stow Manufacturing Co., 65 Shear St., Binghamton, N.Y. It has a 4½ HP, 4 cycle air-cooled gasoline engine and runs at speeds up to 9300 vibrations per minute. This new vibrator has a convenient combination ring guard and carry handle. The flexible shafting can be wrapped around this ring for carrying and it also protects the engine from damage if the vibrator should be tipped over. The engine is mounted on a 360° swivel making it simple to vibrate concrete over a wide area. An automatic centrifugal ball bearing clutch is standard equipment for ease in starting the engine. If desired, the AG model can be obtained with a rubber tired wheelbarrow base.

High speed, reinforced ¾ in. flexible shafting is used, in lengths of 7, 14, or 21 ft. Combination of these lengths can be attached to each other to give longer lengths up to 35 ft. A 2½ in. model 2500 vibrator head with a hardened steel removable tip, is standard on this machine. Additional heads interchangeable with model 2500 are 1600 (1⅝ in. x 10 in.) and model 2000 (2 in. x 10 in.). Wet rubbing or dry grinding of concrete can be done with this machine by removing the vibrator head and using an anglehead.

Model A. G. Concrete Vibrator

For more information circle 107 on Service Coupon Page 16 and mail now.

Self-Propelled Pneumatic Tire 9-Wheel Roller

Smooth handling and full oscillation are among the major features claimed for the new SP-54, self-propelled pneumatic tire, 9-wheel roller, announced by Wm. Bros Boiler & Mfg. Co., 1057 Tenth Ave., S.E., Minneapolis 14, Minn. The roller has 5 front and 4 rear wheels; both

New Bros SP-54 Roller

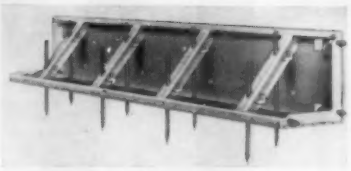
rear wheel pairs have positive chain drive to prevent roller from getting "hung up" by a free wheel. The SP-54's torque converter drive provides even flow of power to driveline for smooth take-off in all forward and reverse speeds. Oscillation of the front and rear wheel pairs is available, which is stated to provide thorough compaction without sacrifice of tractive effort.

The roller is equipped with uniform hydraulic steering for smooth handling at any motor or roller speed; also, it permits easy turn around on an 18 ft. 5 in. radius. The 9-ton compaction load is evenly distributed over the 9 wheels at 2000 lb. per wheel or 265 lb. per lineal inch of rolling width. Full 100% compaction is stated to be obtained by ¾ in. overlap of front and rear tires. A 50 HP engine produces plenty of power for shallow lift compaction jobs. Shuttle speed transmission reverses roller at same speeds as forward range, from 0 to 18 mph. A 125 gal. water tank is standard equipment, though not required to obtain maximum wheel load. Towing tongue is optional.

For more information circle 108 on Service Coupon Page 16 and mail now.

Dual-Duty Road Form

A new improved Heltzel road form introduced by The Heltzel Steel Form & Iron Co., Warren, O., has two different height working faces on each form, enabling a contractor to get two standard heights from a single form simply by turning it on its side. Built entirely of manganese steel for greater strength, the new form combines added strength with setting ease. Forms are furnished with Heltzel hardened steel stakes made of re-rolled rail. Heavy, deep pressed channel sections replace conventional stake pockets. These sections are formed to the



Heltzel Dual-Duty Road Form

inside of both trends and flanges, to give added strength to the tread section.

New type angle wedges are upset in the channel to prevent coming out. They are stated to provide a safe, sure lock regardless of which side of form is up. Dowel lock ends give form a positive lock at all three corners. Dowels are pointed to simplify perfect alignment. For use with conventional equipment, these forms will be supplied with standard slide-lock where specified. Form faces made in any height combination to customer specification.

For more information circle 109 on Service Coupon Page 16 and mail now.

Device Provides Protection From Tire Blowouts

A new safety product, designed to give maximum protection against blowout of tubeless tires, has been developed by The Goodyear Tire & Rubber Co., Akron, O. Known as the Lifeguard Blowout Shield, the device is based on Goodyear's double air chamber Lifeguard principle. Although the tubeless tires developed by Goodyear greatly reduce the possibility of punctures and ordinary blowouts, no tire is blowout proof or immune to injuries from large, sharp objects. The Lifeguard Blowout Shield was designed to give tubeless tires absolute protection from all road hazards.

The new development consists of an inner shield of nylon fabric and has proved thoroughly dependable after many thousands of miles testing under every conceivable road condition. Unlike a tube, the shield is a two-ply nylon diaphragm, which forms an inner chamber by sealing itself against the rim and tire beads. When inflating the tire, air enters through valve, inflates the shield and passes through a small opening to the outer chamber of the tire. Should a blowout occur, air in the outer chamber escapes immediately, while that in the

Cross Section of Tubeless Tire with Goodyear's Lifeguard Blowout Shield Shows Double Air Chamber Safety Feature

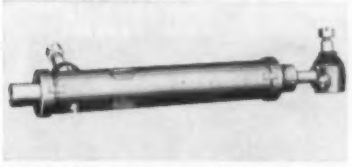
inner compartment leaks out very slowly. This keeps the tire inflated and firmly seated on the wheel permitting the driver to bring the car to a smooth, safe straight-line stop.

For more information circle 110 on Service Coupon Page 16 and mail now.

Steering Booster for Smaller Vehicles

A new low-cost oil-hydraulic power steering booster for smaller vehicles is now available from Vickers Incorporated, 1400 Oakman Blvd., Detroit 32, Mich. The new booster is designed specifically for materials handling vehicles in the 4,000 to 10,000 lb. axle loading class; combines, tractors and other machinery having power ratings of 40 HP and up; busses in the 4,000 to 5,000 lb. axle loading class; city and intercity trucks for 4,000 to 6,000 lb. axle loading; and construction machinery classified for 6,000 to 8,000 lb. axle loading.

Designated Vickers Series S22 Booster, the new unit achieves low cost with a simplified, streamlined double-tube construction. With the new design, assembly tie rods are eliminated and replaced with end caps which are screwed on and secured with removable tack-welded clips. The annular space between the double cylinder walls is utilized for booster oil flow, avoiding the need for external piping. The external tube protects the inner operating cylinder and other working parts from possible stone damage.



New Vickers Series S22 Steering Booster

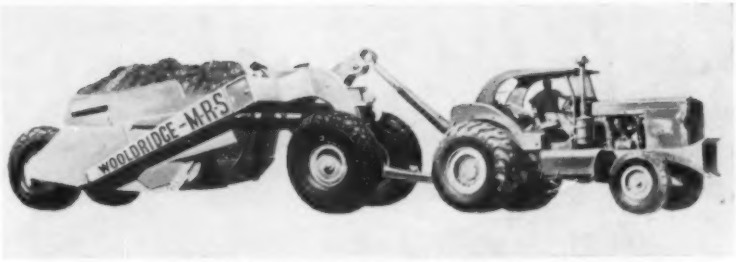
For more information circle 111 on Service Coupon Page 16 and mail now.

Four-Wheel Cable Operated Scrapers

The Wooldridge Manufacturing Division, Continental Copper & Steel Industries, Inc., Sunnyvale, Calif., and the M-R-S Manufacturing Co., Flora, Miss., have jointly announced availability of a special complete line of 4-wheel cable operated scrapers designed for use with M-R-S tractors.

With heaped capacities ranging from 10.5 to 32.5 cu. yd., the five new models are designated as Wooldridge M-R-S OS-80, OS-90, OS-152, OS-200, and OS-260. The units incorporate special "traction masts" for use with the exclusive M-R-S hydraulic weight transfer system, which shifts scraper weight forward to the tractor drive wheels when extra traction is needed. M-R-S 4-wheel tractors are available in 180 to 335 HP models, which are also designed for use as independent prime movers.

Among advanced features claimed for the special scraper line are open bowl design, stabilized balance with extra low center of gravity, true "boiling bowl" loading, large low pressure tires for greater flotation, simple cable reeving, and full-power-forward positive pivot-tilt ejection. The specially manufactured Wooldridge units are to be used only in conjunction with M-R-S tractors and are available through the special exclusive Wooldridge M-R-S dealer organization.



Wooldridge Scraper Unit with M-R-S Tractor

For more information circle 112 on Service Coupon Page 16 and mail now.

Self-Propelled 125 cfm Air Compressor

A new low priced self-propelled air compressor, the Standard Pneupower, is being produced by Schramm, Inc., West Chester, Pa. For several years Schramm has been marketing a self-propelled air compressor (Heavy Pneumatractor) capable of mounting a front end loader and backhoe, and other heavy duty accessories.

Schramm has taken the same 125 cfm engine-compressor power plant as used in the Heavy Pneumatractor for the 125 cfm Pneumapower portable compressor, and built it into a self-propelled tractor unit. None of the compressor performance has been sacrificed — only the tractor features have been modified to permit the lower cost for those customers interested, primarily, in the self-propelled air compressor feature. The Heavy Pneumatractor is still being built and, in conjunction with the new Schramm built front end loader and backhoe, is a versatile piece of universal equipment.

Standard Pneumatractor Air Compressor

For more information circle 113 on Service Coupon Page 16 and mail now.

190 HP Diesel Engine

A completely new 5¾ in. bore by 8 in. stroke, 6-cylinder diesel engine has been announced by Caterpillar Tractor Co., Peoria 8, Ill. Adding to the company's line of modern, heavy-duty diesel engines, the all new Cat D342 is rated at 190 HP for intermittent duty, and replaces the company's D13000 engine. The more compact, modern design of the D342 presents a clean, easily maintained unit composed of many parts already standard in all of the company's 5¾ in. bore engines.

Many other features are included in the D342. These include a new, larger capacity water pump; relocation of lines and tubes which have been placed inside the block for better appearance; and inexpensive, capsule-type fuel injection valves. Three starting systems are available on the unit as attachments. These are: air, direct electric and gasoline. Electric starting for the gasoline starting engine is also available.

The D342 industrial and marine engines with attachments were available as of May 1. D342 electric sets and additional attachments will be announced by Caterpillar at a later date.

For more information circle 114 on Service Coupon Page 16 and mail now.

2 Cu. Yd. Dump Body For Pick-Up Truck

A new general purpose dump body, of 2 cu. yd. capacity and designed for mounting on 1 ton pick-up trucks, has been announced by The Galion Allsteel Body Co., Galion, O. The fixed-side Handi-man, designated Model 2NP, is constructed of 10 gauge high-resistance steel throughout. Understructure consists of 3 in. channel crossmembers and 3 in. channel longitudinals. Model 6NP Handi-man features similar construction plus the added advantage of fully removable sides and rear corner posts. Both models, offered in lengths of 7½ and 8 ft., are 78 in. wide inside. Side height is 12¾ in. and head and tailgate are 6 in. higher than sides. The sturdy double-acting tailgate, fitted with fabricated hardware and up-hook type lower latches, is controlled by a conventional lever mounted at the left corner of the body.

Handi-man bodies are suitable for mounting with Galion Allsteel Model 334N hoists of 4 ton capacity, on trucks with a cab-to-axle distance of 60 in.

Model 2NP Dump Body with Galion Allsteel Model 334N Hoist

For more information circle 115 on Service Coupon Page 16 and mail now.

International New 75 Payscraper

New International Scraper Has Increased Power

The new 75 Payscraper now being introduced by International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., is the largest high-speed, rubber-tired earthmover in the International line. It has a 262 HP diesel engine and can scoop up an 18 cu. yd. heaped load. To take care of that 31⅛% boost in engine power, the entire power train has been strengthened. Increased gear reduction at the final drive puts less torque on the transmission, and reduces shock loads. Radiator capacity has been increased for greater cooling of the larger engine. And the air system has been improved, with a new compressor, new governor controls and a new air line arrangement.

Operator comfort has been stressed to make the Payscraper an easy-riding, easy-to-run machine. More hydraulic operating pressure has been provided to beef up the Payscraper's exclusive Hydro-Steer and give better steering control. Another feature designed to increase ease of operation is the new air-assisted clutch release. The device makes the clutch respond to a touch of the foot on the pedal, and results in more positive clutch engagement.

A new, disc-type cable control unit has also been added. The controls are easier for the operator to manipulate, both when loading and ejecting, and the new unit gives him more positive action and better control of the apron and bowl with less effort.

The unit is designed for faster, easier loading. Down pressure applied through mechanical leverage drives the three-piece cutting blade into the ground and speeds up digging and loading action of the scraper. A penetrating action takes place when the blade meets forward travel resistance. In tough going, the entire weight of the scraper bowl rests on the cutting edge, giving added penetrating force. The location and pitch of the cutting edge sets up a boiling action that fills the entire area of the bowl and front apron in a short digging distance. To achieve faster dumping, the floor of the scraper is tilted, producing positive, clean discharge of load. Hinged back of the cutting blade, the tilting floor sweeps and pushes the load out of the bowl and cleans the stationary curved back and bowl sides.

The tractor has five forward transmission speeds and one reverse speed, ranging from 2.77 to 24.75 miles per hour. Included in the electrical system are two 12-volt batteries, a 24-volt, 20 ampere generator, a 24-volt push-button starter and 12-volt, sealed beam headlights with resistors. The weight of the entire unit is 52,000 lb.

For more information circle 116 on Service Coupon Page 16 and mail now.

Two New Ice Control Units

Two new ice control units, the "Salt Misers" have been announced by Baughman Mfg. Co., Jerseyville, Ill. Both units can be attached to the tailgate of any standard dump truck. Model 55 Salt Miser operates on an auxiliary gasoline engine. Material fed into the 200 lb. capacity hopper feeds into a volume-control valve, which regulates the amount of spread, and through metering valve which feeds the material to the distributor blades in an even flow of the quantity called for by the volume-control valve. The auxiliary gas engine is so economical, according to the manufacturer, that it costs little more to operate it continuously than it does to start and stop it between spreading sites. Operator controls spreading operation by conveniently located hand clutch. During normal spreading operation motor runs at idling speed, to increase width of spread, engine speed is increased by easy-to-reach throttle control.

Salt Miser Ice Control Unit

Model 55-H Salt Miser is powered by a hydraulic unit. The hydraulic pump is powered by a chain and sprocket attached to the U-joint on the truck's power take-off shaft which also powers the dump body hydraulic lift cylinder. Quick-disconnect couplings permit easy removal of the unit during summer months. Spreader remains in horizontal position when dump body is raised or lowered. Ice control material (salt, sand, chloride, etc.) slides into intake opening of spreader by gravity, for sure, dependable feed.

For more information circle 117 on Service Coupon Page 16 and mail now.

High-Speed Semi-Automatic Hard-Facing

A new line of tubular fabricated alloy wires designed for open arc application through standard semi-automatic welders has been announced by Stoody Co., Whittier, Calif. Essentially, this is stated to be a new process that requires no flux and offers the versatility of manual welding with the control of the full automatic. Depositing 7 to 15 lb. of hard metal an hour, this "material-and-method" combination is stated to make possible a welding speed two or three times that of the manual process.

Tooth from 5-Yd. Bucket Built Up with Repointer, Using the Semi-Automatic Method with Stoody Nickel Manganese, Followed by a Hard-Facing Overlay of Stoody 121

Three materials are now in production at the Stoody Company plant in Whittier: a 50% high chromium hard-facing alloy, a 20% alloy for hard-facing and a Hadfield nickel manganese for build-up of manganese steel parts. The 7/64 in. wires now available are identical in composition to Stoody tubular electrodes and wires in common use throughout the country; each has been thoroughly proven by extensive field testing and by many years of successful use in industry. Other materials will be announced as tests now under way are completed.

Savings in labor as a result of the exceptionally high deposition rate is but one advantage claimed for the new wires.

You Can't Beat This Pair of Winners for LOW COST PRODUCTION

for your ¾ and 1-yard requirements

Marion 32-M ¾ cubic yard hoe

Marion 43-M, Heavy-Duty Dragline

Extra Profit Facts About The 32-M

- Fast, in-the-field conversion from hoe or shovel to crane, dragline, clamshell, pile driver.
- Large multiple disc type swing clutches give smooth, cool performance.
- Long, wide crawlers, location of deck machinery makes center of gravity far to the rear of the machine for extra stability.
- Independent worm type boom hoist powered up and down.
- Deck gears recessed in oil bath and anti-friction bearings help insure durability and reduce costly downtime.
- Torque converter for smooth operation (optional).

Extra Profit Facts About The 43-M

- Readily convertible as shovel, dragline, clamshell, crane, hoe and pile driver.
- Fast operation, easily controlled with Marion Air Control.
- Unsurpassed machine quality and dependability results from alloy steels, forgings and anti-friction bearings.
- Travels easily on carryall — no highway problems.
- More heavily built throughout than any machine of comparable rating.

Here are two machines engineered for your needs that will provide highly profitable production, economical operation with minimum maintenance for years to come.

Thousands of contractors are now enjoying the extra profit dividends of these job-proven performers — the MARION 32-M and 43-M. On top of the list of many extra benefits, facts prove they are producing really low cost production.

We'd welcome an inquiry and the opportunity to give you all the extra profit facts on these two heavyweight performers. See your nearest distributor today.

MARION • OSGOOD • GENERAL O-G

MARION POWER SHOVEL CO. • MARION, OHIO, U. S. A.

A Subsidiary of Merritt-Chapman & Scott Corporation

POWER SHOVELS FROM ½ TO 60 CUBIC YARDS
PILE DRIVERS • WALKING DRAGLINES

DRAGLINES • CLAMSHELLS • CRANES • BACKHOES
TRUCK CRANES • MOBILCRANES • LOG LOADERS

Your Confidence Is Justified Where This Flag Flies

. . . for more details circle 254, page 16

Normal 10% loss for stub ends, an important item with manual electrodes, is eliminated. Since they are bare, these wires are approximately 90% efficient, and there is no slag removal problem.

In operation, semi-automatic welding using the Stoody tubular wires is much like manual welding but wire feed is continuous and both feed and arc control are automatic. Application by open arc gives complete visibility at all times. Deposits bond well to the base metal with very little penetration or dilution and either stringer beads or wide wash passes can be used, depending upon the part and type of deposit desired. Current required for the semi-automatic wires does not exceed 350 amps and a power source of not less than 400 amps is recommended. Almost any standard semi-automatic welder, with minor adaptations, can be used for the process. A welding nozzle, special grooved feed rolls and supplementary wire guides are all that are required to make the conversion in most cases. Such parts as are necessary can be ordered as a kit from Stoody distributors.

For more information circle 118 on Service Coupon Page 16 and mail now.

New Cedarapids Portable Crushing Plant

A new Cedarapids portable crushing plant, the "Corporal," for producing crushed gravel or rock where the finished product does not have to be graded, has been announced by Iowa Manufacturing Co., Cedar Rapids, Iowa. The new plant consists of a rugged, welded steel hopper designed for heavy feeding, a 14 in. x 24 in. Cedarapids roller bearing jaw crusher, an 18 in. x 23 ft. 3 in. delivery conveyor and choice of power units all mounted on heavy-duty gooseneck full trailer with 10 in. truck frame.

Low loading height (7 ft. 8 in.) of the hopper makes it easy to feed with a power shovel. The "Corporal" is a highly portable unit with no obstructions extending beyond the tires, can easily be towed down any road that a truck can travel and be backed up to the face of the gravel bank and put into operation simply by lowering the conveyor into position and setting the screw-type jack supports.

The Cedarapids jaw crusher is the overhead eccentric type with fully stress-relieved welded steel base. Extra large, spherical, self-aligning bearings are equipped with labyrinth seals to insure minimum lubrication requirements, effective dust and moisture seal. Lubrication needed only after approximately 1,000 hours of operation, or as required by seasonal changes to facilitate starting. Safety toggle plate provides protection against tramp iron or other uncrushable material. Crusher openings easily changed while crusher is in operation.

"Corporal" Portable Crushing Plant

For more information circle 119 on Service Coupon Page 16 and mail now.

Portable Batching Plant

The new E-3 Batchmaster cement plant, announced by The Heltzel Steel Form and Iron Co., Warren, O., is designed for easy erecting and dismantling. It can be carried over the highways without special permits. The new plant will carry any type or size batcher up to 70 cu. ft. The plant alone will hold 608 bbl. of cement. Single or multiple recirculators will increase the capacity to any amount required. It is all welded with sturdy, wide flange H columns flared to provide an extra wide truck entry. Plant can be equipped with any range of elevator capacity up to 425 bbl. per hour.

Heltzel E-3 Batchmaster Cement Plant

For more information circle 120 on Service Coupon Page 16 and mail now.

Third Drum Assembly For B-E Machines

A third drum assembly, particularly useful in pile driving work or for any purpose where a third hoist line is needed, is now available for Bucyrus-Erie 38-B, 51-B and 54-B machines equipped with lifting crane or clamshell front ends, according to an announcement by the Bucyrus-Erie Co., South Milwaukee, Wis. The auxiliary assembly equipment can be mounted on any of these models in the field provided they do not have independent propel. The main units of the third assembly are the clutch shaft and mounting, drum and drumshaft, boom equipment, and operating controls.

The clutch shaft mounts directly in front of the hoist drum and is driven by the hoist gear. The third drum and its shaft are mounted in front of the clutch shaft, and are chain driven from it. Drum shaft is adjustable for chain take up. A hand lever control for operating clutch and a foot pedal for applying brake are located at operator's station. Drum capacity is aproximately 300 ft., using ¾ in. dia. cable. For a single part line, maximum load is 10,000 lb. and line speed is 160 ft./min.

Third Drum Assembly

For more information circle 121 on Service Coupon Page 16 and mail now.

Truck Grader Has Positive Anti-Chatter Moldboard

An entirely improved version of the underbody truck grader for maintaining secondary gravel roads has been announced by Lull Engineering Co., 7700 Cedar Ave., South, Minneapolis, Minn. Known as the Model 10, this grader offers a positive anti-chatter moldboard that is claimed to do an excellent job of maintenance at highly increased speeds. The outstanding advantages claimed for this new underbody grader is its higher operational speed of 6 to 15 miles an hour. Higher maintenance speeds are made possible by levelizing skiis located behind and toward each end of the moldboard. These skiis and the vertical supporting hydraulic cylinders oppose any tendency for the blade to chatter by absorbing the resiliency bounce transmitted by truck springs and tires as well as shocks from the road. For example, when dips in the road surface are encountered, the skiis exert an upward force on the moldboard, keeping it in a level plane. Material rolled along by the moldboard fills in the dips and holes. Conversely, when the moldboard strikes humps, the vertical cylinders exert a downward force, causing irregularities to be sliced off.

New Lull Truck Grader

For more information circle 122 on Service Coupon Page 16 and mail now.

Self-Widening Mechanical Finishing Machine

A mechanical finishing machine that will widen with a flick of a finger right from the operator's stand has been placed on the market by The Flexible Road Joint Machine Co., Warren, O. This, it is claimed, will enable road

Flex-Plane Self-Widening Finisher

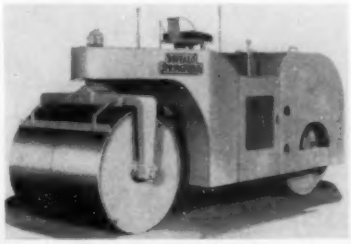
builders to save many hours in finishing interchanges, intersections, passing areas, pull-off areas or wherever the width of a highway varies.

Simply set forms to follow the actual path of the finished roadway, pour the concrete and the Flex-Plane self-widening finisher will do the rest. The frame widens, not the wheels. A specially designed triple-lap frame gives the machine utmost rigidity even when completely expanded. It is claimed to give the finished roadway greater uniformity, reduce hand labor, and permit the finish of wide and variable width areas without special form set-up and pouring operation. It can be used as a standard straight-line finisher, and with an extra wide range of widths.

For more information circle 123 on Service Coupon Page 16 and mail now.

New Series 8-12 and 10-14 Ton Tandem Rollers

A new series of 8-12 and 10-14 ton tandem rollers, to be known as Standard tandems, has been announced by Buffalo-Springfield Roller Co., Springfield, O. One of the outstanding features of these new Standard tandems is their ability to match power and speed automatically to grade and material variations, through use of torque converter drive. The torque converter prevents engine lugging during heavy starts or sudden load increases, and permits engine operation within governed rpm range for peak power, efficiency, and economy. Shockloads and torsional variations are absorbed. Steady, constant speeds are maintained at any selected speed from 1 to 5 mph, and shifting is eliminated, permitting the operator to concentrate on the job for greater efficiency. Through the cushioned drive of fluid, the torque converter provides a smooth, steady flow of power that prevents roll slippage, and also eliminates the shocks and surges of reversing.



Buffalo-Springfield's New Standard Tandem

For more information circle 124 on Service Coupon Page 16 and mail now.

For more ideas on Equipment and Materials . . . . . see page 148

Manufacturers' Literature

Aluminum Bridge Railings

A 52-page manual published by Reynolds Metal Co. shows designs which use aluminum for bridge railings most efficiently. Based directly upon experience with actual bridge railing installations, the book includes a study of architectural considerations, complete design details, recommendations for joints, endings, and post settings, surface treatment and insulation. Tables present data on allowable unit stresses for various aluminum alloys for railings and posts, for bolts and nuts, and for welded connections; mechanical properties of aluminum alloys for structural rail members; and the new aluminum alloy designation system. Cost studies show weight per running foot and comparative cost for complete aluminum bridge railings of our typical designs detailed in the book. This section also includes comparative prices and properties of the extruded aluminum members. This 52-page, 8½x-11-in. manual contains 110 illustrations and 27 tables. It will be sent without charge upon request to Desk PR, Reynolds Metal Co., 2500 South Third St., Louisville 1, Ky.

For more information circle 125 on Service Coupon Page 16 and mail now.

Power Shovels, Cranes, Draglines, Pull Shovels

Revised descriptive bulletins covering the Lima Type 34 and 44 power shovel, cranes, draglines and pull shovels on crawler and wheel mounts have been announced by Baldwin - Lima - Hamilton, Construction Equipment Division. The Type 34 is a ¾-yd. shovel and 20-ton crane on both crawler and wheel mount. The Type 44 is a 1-yd. shovel and 25-ton crane on both crawler and wheel mount. Bulletins can be obtained by writing Baldwin-Lima-Hamilton Corporation, Lima, O., attention Advertising Department.

For more information circle 126 on Service Coupon Page 16 and mail now.

"Quick-Way" ½ Cu. Yd. Shovel

A new 3-color, 6-page bulletin describing and illustrating the construction and capacities of the "Quick-Way" ½ Cu. Yd. Model L-2, has been issued by "Quick-Way" Truck Shovel Company, Box 1800, Denver, Colo. Features of the L-2 are enumerated, and digging ranges and ratings are listed and illustrated by means of charts. In addition, the bulletin includes specifications of the new "Quick-Way" carrier.

For more information circle 127 on Service Coupon Page 16 and mail now.

Tapes and Rules

A new 160-page catalog (No. 104) issued by Lufkin Rule Co., Saginaw, Mich., covers its complete line of tapes and rules. It is divided into sections devoted to steel tapes, engineers tapes, oil gaging tapes, surveying and chain tapes, woven tapes, tape rules, spring joint rules, lumber rules, and miscellaneous section of special rules, gages, squares, etc.

For more information circle 128 on Service Coupon Page 16 and mail now.

Concrete Paving Spreaders

Specincations for the Model SD Blaw-Knox concrete paving spreader and vibrator are detailed in a new Bulletin No. 2485, which is available from Construction Equipment Division, Blaw-Knox Co., Pittsburgh 38, Pa. Along with engineering data, the bulletin includes shots of the spreader at work on the New York Thruway, the Ohio Turnpike and other well-known construction jobs. The machine described in the bulletin is suitable for both road and airbase concrete spreading.

For more information circle 129 on Service Coupon Page 16 and mail now.

Drillers Handbook on Rock

Publication of a "Drillers Handbook on Rock," reputed to be one of the most comprehensive drilling manuals ever compiled, has been announced by Davey Compressor Co., Kent, O. The 68 page, pocket-size booklet contains a complete description of all common rocks. It discusses their hardness, texture, fracture and formation in detail. Readers are instructed how to judge the speeds with which various rocks can be drilled. A method by which the driller can establish a "point system" to figure drillability and drilling cost is also outlined. The handbook contains 71 illustrations and 15 charts. Other features are a glossary of approximately 150 commonly used rock and mineral technical names and terms. Modern drilling equipment, ranging from light hand rock drills to large truck-mounted rotary air and mud drills, are il-

Huge Mobile Crane for Navy

Contractors as well as military men are showing interest in big mobile "picker-uppers" these days. The latest is the Navy's new MB-1 mobile crane, able to pick up a four-engine bomber and walk away with it.

This crane was made public recently at a demonstration at Floyd Bennett Field Naval Air Station, N. Y.

The new crane, developed under the sponsorship of the Chief of the Bureau of Aeronautics, is destined to play a vital role in aircraft handling operations at U. S. Naval Air Stations around the world.

A 48-ton giant, able to travel at speeds up to 40 miles-per-hour, the MB-1 features controls so precise that it can raise a weight of 80,000 lb. and lower it gently.

Designed and built by the LeTourneau-Westinghouse Company in cooperation with Navy engineers, the machine incorporates many devices and principles which have been proved on heavy earthmoving equipment built by the firm.

Electricity is used extensively for the power and controls of the machine. A series of positive action electric fingertip switches mounted on the instrument panel, control steering as well as the action of powerful electric motor and gear box units to move cables which operate the hook, boom and carriage of the crane.

● This mobile electronically-controlled crane developed by LeTourneau-Westinghouse could easily pick up a heavy tractor or power shovel.

lustrated and described. Booklet copies are priced at $1.50 each and may be ordered from the Rock Drill Division, Davey Compressor Co., Kent, O.

For more information circle 130 on Service Coupon Page 16 and mail now.

Maintenance Manual for Unpaved Roads

The handy size, 36 page maintenance booklet "Maintenance Tips for Unpaved Roads," published by the Calcium Chloride Institute, was written to help patrolmen, maintenance supervisors, and engineers obtain best results from the use of calcium chloride on unpaved roads. Separate sections of the booklet deal with normal maintenance operations and specific questions and tables are included. The information presented is designed to produce specific maintenance procedures for unpaved roads, and it is the result of many years of field experience and laboratory research. The Institute claims the proper use of calcium chloride on a road will save about 75% of the aggregate replacement and blading costs. In addition, it will give a dust-free, smooth-riding surface all year round. For a free copy of "Maintenance Tips for Unpaved Roads," write directly to the Calcium Chloride Institute, 909 Ring Building, Washington 6, D.C.

For more information circle 131 on Service Coupon Page 16 and mail now.

Caterpillar D8 Tractor

A 4-page booklet on the completely new Caterpillar D8 tractor has been released. The booklet depicts the new unit in both torque converter and direct drive models. Some of the new advance designs mentioned in the booklet are engine, controls, "life shaft" drive, welded one-piece steering clutch case, 7-roller track frame, "water-quenched" track shoes, hydraulic booster steering, starting engine, "in seat" starting, larger fuel tank and new attachments. Complete with new specifications on both the torque converter model and the direct drive model, the book, Form 31496, may be obtained from Caterpillar Tractor Co., Peoria 8, Ill.

For more information circle 132 on Service Coupon Page 16 and mail now.

Tractor Shovels

Design, construction, operation and correct application of 1 cu. yd. capacity Michigan '75' tractor shovels are described and illustrated in a new 12-page catalog (No. 7500-P) offered by Clark Equipment Co.'s Construction Machinery Division, Benton Harbor, Mich. Models for application on all job conditions are described, including an all-wheel drive, a front-wheel drive and a rear-wheel drive. How a power shift transmission reduces operator fatigue and speeds work cycles, why a torque converter cushions shock loads and increases digging power, why planetary-wheel drive axles mean elimination of axle shaft breakage — these and other operational characteristics are explained. Four big cutaway drawings illustrate how principal components of the Michigan power train are built and how they

work. Optional attachments show the numerous jobs that can be done with a rubber-tired tractor shovel. Available are forks, backfiller blades, crane boom, snow plows, cabs, light material buckets, high flotation tires and hard rock tires. A range chart gives dimensions on all major attachments.

For more information circle 133 on Service Coupon Page 16 and mail now.

Earth Tamping Machine

The new, improved Wayer impactor, Model D-25, is illustrated and described in a 4-page bulletin available from Wayer Impactor, Inc., 175 Hosack St., Columbus 7, O. This model is powered by a 2½ HP Wisconsin air cooled engine. The finishing plate is cold rolled steel 25 in. by 8 in. by ¾ in. thick with a 25 in. by 2½ in. tamping area heated by engine exhaust. The unit is self-propelled with a working speed on level ground of 22 to 30 ft. per minute. The machine delivers 1900 blows per minute, each of 1250 lb. impact.

For more information circle 134 on Service Coupon Page 16 and mail now.

Gradall in Railroad Jobs

A new folder illustrated with 28 photographs of multi-purpose Gradall machines at work on railroad earth moving, grading and materials handling jobs has been issued by Gradall Division, The Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, O. The photographs show both the railroad model Gradall mounted on a track-climbing truck and the crawler mount model at work on a wide variety of railroad jobs. Gradalls are pictured at work on such operations as ditch cleaning, emergency work, grade cuts and fills, track relocation, excavating, railway track aligning, pavement removal, distribution of ballast, snow removal and crane work. A number of the special attachments such as formed buckets, a single tooth ripper, a gooseneck material handling boom extension and a convenient grapple which operates with the flexibility of a giant hand for unloading and piling such materials as railroad ties are shown in operation in the photographs.

For more information circle 135 on Service Coupon Page 16 and mail now.

Complete Line Drott Skid-Shovels Listed

A new catalog listing the complete line of International Drott Skid-Shovels and attachments has been published. The four Skid-Shovels are designed for use with the International T-6 or TD-6 crawler; the T-9 or TD-9; the TD-14A, and the TD-18A. Bucket capacities range from ¾ to 3 yd. The catalog includes the International Drott "Four-In-One" Skid-Shovel — that versatile unit which the operator, with the flick of a lever, can transform into a Skid-Shovel, a bullclam, a clamshell or a bulldozer. Attachments listed in the 16-page catalog are an extra heavy-duty bucket; a radius control bulldozer blade, interchangeable with the bucket by the removal of only four pins; a log and pulpwood rack, a combination rack with a flat bed for handling ties and lumber which can be changed in one minute to a curved bed for moving logs; a scarifier; a rock fork; a grubber blade, and a bullangledozer blade. The catalog contains specifications on all these machines and pictures of them in action. A free copy may be obtained by writing to Drott Mfg. Corp., Milwaukee 8, Wis.

For more information circle 136 on Service Coupon Page 16 and mail now.

Bituminous Batch Plants

A new, 12-page, 3-color folder illustrating the basic principles of its new Model 890 series "Batch-O-Matic" batch plants is available from Barber-Greene Co., 400 No. Highland Ave., Aurora, Ill. The "Batch-O-Matic" batch plants are stated to differ from the ordinary in four major areas: the aggregate measuring principle; the asphalt measuring principle; in the design of the pugmill and in the fact that the Barber-Greene plants have been designed from their inception for full automatic operation with manual operation as the optional, instead of the reverse as is generally the situation.

By way of basic indoctrination to the reader, all of these principles are explained by word and by means of a schematic, cut-away drawing of the entire plant. The folder then proceeds to provide a detailed explanation of each principle.

For more information circle 137 on Service Coupon Page 16 and mail now.

Heavy-Duty Excavation Dump Bodies

A special 2-color catalogue sheet released by Hercules Steel Products Corporation, Galion, O., provides detailed information on the Hercules HD Series heavy-duty excavator bodies. Complete product specifications are given together with illustrations showing bodies designed for both underbody and front telescopic hoists applications. These data include standard lengths, capacities, suggested hoist applications and complete construction specifications.

For more information circle 138 on Service Coupon Page 16 and mail now.

Hydraulic Power Steering Systems

A new four-page, three-color, well-illustrated catalog describing standard Vickers units for developing a wide variety of hydraulic power steering systems is now available from Vickers Incorporated, 1400 Oakman Blvd., Detroit 32, Mich. The catalog (M-5106) presents the new line of Vickers oil-hydraulic power steering components for trucks, buses, material handling and other commercial type vehicles. These include the new S-23 series power steering boosters, vane type power steering pumps, the combination volume control and overload relief valve, and an oil reservoir. Photographs of these units are accompanied by complete product description.

For more information circle 139 on Service Coupon Page 16 and mail now.

Motorpumps, ¼ to 73 HP Sizes

A completely new 24 page motorpump bulletin, Form 7093-E, has been released by Ingersoll-Rand, 11 Broadway, New York 4, N.Y. It covers their entire line of close-coupled motorpumps from ¾ to 75 HP sizes for delivery of 5 to 2800 gal. per minute. The bulletin is designed to make it easy to select the correct size and model. A visual and concise index shows the basic classifications of pumps covered with their specifications. The next three pages highlight the advantages of the motorpump and point up its design features. On the following pages each class of pump is explained and illustrated in detail. In the heavy-duty range a 75 HP pump has been added to the line. Also illustrated are self-priming units and jet pumps. Modifications that can be made to standard units are shown thus providing hundreds of combinations to meet specific requirements. Four pages are given over to tables of dimensions, weights, performances and mountings. Two pages offer a typical pumping problem with its solution, plus pipe friction tables.

For more information circle 140 on Service Coupon Page 16 and mail now.

FWD's Heavy Duty Trucks

Three new brochures, describing FWD's new 1955 Series 100, 200, and 300 heavy duty trucks, have been published by the Four Wheel Drive Auto Co. Each brochure features a different FWD truck series — "100" for 14,500 and 17,500 lb. G.V.W., "200" for 22,000 to 28,000 lb. G.V.W., and "300" for 32,000 to 36,000 lb. G.V.W. The new brochures highlight FWD's greater driving power and increased load capacity with four-wheel-drive advanced math-matic design, which proportions engine torque to weight on front and rear axles by means of exclusive FWD power-proportioning center differential. Complete specifications of each truck series are included. The FWD publications, each eight pages, may be obtained by writing to Sales Promotion Department, Four Wheel Drive Auto Co., Clintonville, Wis., requesting the Series "100," "200," and/or "300" brochures.

For more information circle 141 on Service Coupon Page 16 and mail now.

115 to 410 HP Engines

A new 8-page bulletin (No. E-9) issued by Sales Promotion Department, Le Roi Division, Westinghouse Air Brake Co., 1706 South 68th St., Milwaukee, 14, Wis., describes and illustrates the 115 to 410 HP LeRoi L3000, H2000 and F1500 engines.

The bulletin uses cutaway views and photographs to show advanced features such as modern valve-in-head design. This design is stated to incorporate a more nearly perfect combination chamber producing more horsepower per fuel dollar. Basic specifications are also included.

For more information circle 142 on Service Coupon Page 16 and mail now.

Street Name Signs

A new catalog on street signs has been issued by Municipal Street Sign Co., Inc. 777 Meeker Ave., Brooklyn 22, N.Y. Illustrated and described are the following porcelain signs with cast tingzaloy frames, with porcelain steel frames, and with embossed letters without frames; and cast aluminum signs with raised letters. A page is devoted to plastic traffic signs for streets and highways.

For more information circle 143 on Service Coupon Page 16 and mail now.

All-Wheel-Drive Trucks

A new 8-page brochure tells the complete Marmon-Herrington all-wheel-drive story. It covers engineering and manufacturing background, heavy, medium and light duty models, chassis and engineering features, and condensed specifications. A large inside spread illustrates a Marmon-Herrington Ford chassis and describes 6 Marmon-Harrington Ford features: constant velocity universal joint steering ends; full floating front drive axles; husky, heavy duty truck engines; heavy duty synchro silent transmission; extra strong reinforced frames; gear driven auxiliary transmissions. Copies of this new brochure are available by writing to Sales Promotion Manager, Marmon-Herrington Co., Inc., 1519 W. Washington St., Indianapolis, Ind. (Ask for No. 550301).

For more information circle 144 on Service Coupon Page 16 and mail now.

Cary-Lift All-Purpose Loader

The Pettibone Cary-Lift, an all-purpose loader is described in a new, 36-page brochure released by Pettibone Mulliken Corporation, 4700 West Division St., Chicago, Ill. Numerous photographs demonstrate how the versatile Cary-Lift can tackle a wide variety of yard and field loading tasks. Emphasized is the machine's unusually long reach and ability to extract itself from mud, sand, snow, etc. without assistance from other machines. Shown also is the Cary-Lift's ability to sort, pick, carry and place loads under all-weather operating conditions over unpaved, soft terrain. Featured is its usefulness for such tasks as handling dirt, snow, coal and aggregates with 1-yd. and 4-yd. slip-on buckets, or with scoop or bottom-dump buckets interchangeable with the fork. Complete operating and construction features, specifications, accessory equipment and time-saving, cost-saving advantages are detailed for four different models — fork, swivel clam, sling and super sling.

For more information circle 145 on Service Coupon Page 16 and mail now.

Stabilizing Road Shoulders with Rock Salt

A new pamphlet, "Issue No. 5 — Stabilizing Shoulders," has been published by International Salt Co. It contains practical information and on the job assistance for stabilizing road shoulders with rock salt. This pamphlet is the latest in the series entitled, "Better Highways Through Salt-Soil-Stabilization." Copies of it and the other four in the series are available from International Salt Co. Inc., Scranton 2, Pa.

For more information circle 146 on Service Coupon Page 16 and mail now.

Triplex Mower

A new illustrated leaflet featuring their new triplex mower has been issued by Worthington Mower Co., Stroudsburg, Pa. This is a new three-gang, self-propelled mower and riding sulky built as an integral unit. Details of the new mower, developed after many years of research, are completely covered by this bulletin.

For more information circle 147 on Service Coupon Page 16 and mail now.

Heavy Duty Diesel Engines

A new 20-page bulletin (Form 10,-040) describing features of their Type "S" and "SS" heavy duty diesel engines in sizes from 375 to 1000 hp, announced by Ingersoll-Rand, 11 Broadway, New York 4, N.Y., provides complete information about the lubrication, cooling and fuel injection systems of the engines. It furnishes details about engine housing design, full floating aluminum bearings, large diameter crankshaft, gear driven auxiliaries and other features. Included also are specification and dimension sections and a number of illustrations of the engines and component parts.

For more information circle 148 on Service Coupon Page 16 and mail now.

Bituminous ROADS AND STREETS

Published by Gillette Publishing Company
22 West Maple Street, Chicago 10, Illinois

Lee Richardson, Inc., contractor, at work on 28-mile asphalt road job in Montana — longest of its kind. See article beginning page 128.

Montana's Longest Asphalt Paving Run
Views and Comments
Asphalt Institute Headquarters Dedicated
What's New in Equipment and Materials

JUNE 1955

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Here are the manufacturers represented in Gillette's Heavy Construction Prefiled Catalog:

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Barber-Greene Company
Bicknell Manufacturing Co.
Blaw-Knox Company
Briscoe & Son, E. B.
Bros Boiler & Mfg. Co., Wm.
Buffalo-Springfield Roller Co.
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Chrysler Industrial & Marine Engine Corp.
Clark Equipment Company
Cleveland Trencher Company
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Concrete Surfacing Machine Co.
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Cummins Engine Co., Inc.
Detroit Diesel Engine Div.
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Erie Strayer Company
Flexible Road Joint Company
Flintkote Co.
Galion Iron Works & Mfg. Co.
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Joy Manufacturing Company
Keystone Asphalt Products Company
Kiesler Company, Jos. F.
La Crosse Trailer Corporation
Le Roi Company
Littleford Bros., Inc.
McKiernan-Terry Corporation
Mid-Western Industries, Inc.
Minneapolis-Moline Company
Naugatuck Chemical Div.
Owen Bucket Company
Pacific Car & Foundry Co.
Pioneer Engineering Works, Inc.
Reliance Steel Products, Inc.
Republic Steel Corporation
Rogers Brothers Corp.
St. Paul Hydraulic Hoist
Seaman Motors, Inc.
Servicised Products Corp.
Shawnee Mfg. Co., Inc.
Shunk Manufacturing Co.
Stow Manufacturing Co.
Symonds Clamp & Manufacturing Co.
Timken Roller Bearing Company
Toncan Culvert Association
United States Rubber Company
United States Steel Corp.
United Steel Fabricators, Inc.
Wellman Engineering Company
Wico Electric Company
Wisconsin Motor Corporation

MONTANA'S

38-Mile paving project, sandwiched between two similar jobs, modernizes longest highway section in state's history

By Les Peak
Lou Richardson, Inc., Paving Contractors
Miles City, Montana

THE longest asphalt paving job ever by the Montana State Highway Commission has just wound up in a blaze of speed between Crow Agency and Broadus. Thirty-eight miles of continuous 2-lane pavement was laid by Lou Richardson, Inc., of Miles City. To make the paving feat all the more remarkable, two other contracts joined each end of the 38-mile job to make an over-all 62-mile project. In many respects the job which finished at the tail-end of the 1954 season may have set new performance marks for 1955 contracts.

Located on secondary State Highway 8, the job will cut 155 miles off the transcontinental driving distance over the northern route between Minneapolis and Portland. It will carry traffic quickly through some of southern Montana's most scenic terrain, including high mountainous elevations east of Custer Battlefield National Monument.

Montana stretched its road dollar by retaining most of the existing alignment. The grade was widened. Sharp vertical curves flatted down quickly as grading equipment got busy. The old gravel surfacing was retained in most places; then beefed up with extra crushed rock to develop a heavy sub-base with good bearing value. Future traffic is bound to include many an 18,000-pound axle load. The improved grade and sub-base was then topped out by 24 feet of plantmix asphalt 3½ inches thick.

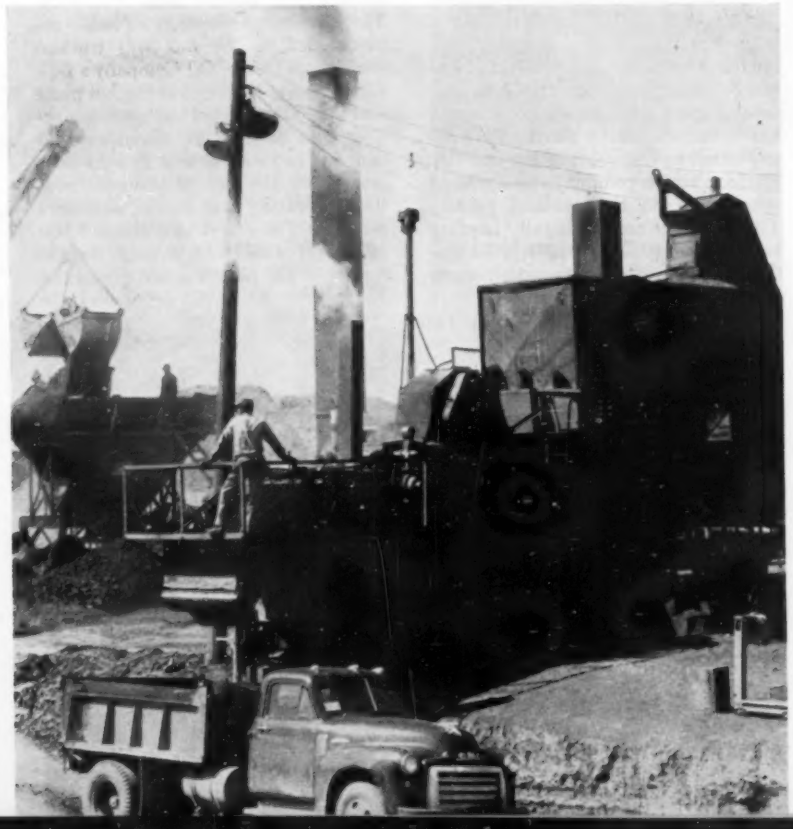
Quantities ran heavy. There were 186,000 tons of base course rock, 160,000 tons of cushion course rock, and 65,000 tons of plantmix. Coupled to the urgency of completing the job before winter snows set in, Richardson's crews had their work well cut out from the start. The three contracts in Richardson's 38-mile paving job top out close to 5,000 feet above sea level near Ashland, Montana, and even with the best of autumn weather, working time was definitely limited.

LONGEST ASPHALT PAVING RUN

● Pioneer hot plant with auxiliary dryer turned out plant mix for the Richardson job.

Every preliminary estimate, where rock production was balanced against the working time available, pointed up the importance of getting in with a high-capacity rock production setup. Solution to this problem resolved itself into two separate crusher-screening plants. The first unit was self-contained Pioneer 40-V portable outfit with a 10x36 jaw, 40x22 rolls, Pioneer conveyors and screens, two Caterpillar D8's with U-dozers for the raw feed, and Caterpillar D13000 power. Using its own fleet of trucks, this portable plant operated from several pits to turn out about 40 per cent of the job tonnage.

The second plant was a shop-assembled outfit, using a homemade feeder trap, a Pioneer apron type feeder, a Pioneer 10x36 jaw, Pioneer 40x22 rolls, a double 4x12-foot screen deck, stacker conveyor system, and a 21-yard surge hopper. Output of this unit was 250 tph, just slightly more than that of the 40-V in the other plant.



● High speed truck dispatching was facilitated by low level pit.

Principal problems in rock crushing centered around the necessity for maintaining this operation at high output, and there was also difficulty in material control. Much of the native rock in the Ashland locality is sandstone, scoria, and other forms of material which pulverizes excessively, but has excellent characteristics otherwise. It was practically impossible to crush this material without developing 200-mesh fines near the upper percentage limits, particularly if the crushers were set at usual clearances for manufacturing that size material. The problem was solved in that regard by opening up the jaw crusher slightly, and running the rolls about ¼ inch wider than normally set.

In spite of high altitude and an even more interesting factor — the variable specific gravity of the rock — production stayed high. It amounted to approximately 450 tph for the two plants. Considering the often-low specific gravity of the material, that was unusually good, because instead of weighing 3,200 lb. per cu. yd. as most crushed rock weighs, this material seldom went over 2,650, and was often

● Richardson's asphalt plant set-up is shown in the background. Rock plant in foreground is turning out mineral aggregate and base course material.

● This general view shows the Pioneer 40-V crusher, which produced about half the rock in Richardson's contract.

as low as 2,300 lb. Veteran crusher men couldn't believe the tonnage figures in the light of the fullness of their conveyor belts.

The crushed base course material, reduced in size to 1-inch minus, was used for leveling off a 3-inch minus pit run course which topped out the subgrade. Typically western methods of processing this rock were used. It was dumped by trucks, then bladed across the road several times by motor graders while moisture was added. After the blending process was finished, the crushed material was bladed off in thin lifts and rolled by rubber-tired rollers. This was done on a grade shaped just previously by tractors and scrapers.

High Production Needed

Hurrying to get the 38-mile job paved before winter storms hit the high country, our crews needed every ounce of asphalt production the hot plant could turn out. The company owns a Pioneer Continuflo plant which has done several of Montana's most important paving jobs, and it was this machine which company management selected to do the Ashland paving. The hot plant crew was fully familiar with its operation, and everyone knew the plant could be depended on to produce at capacity for the many weeks during which paving would be in progress. Fully portable, the plant would also be easy to move, because two operating sites would be required. The first site was at the rock pit 12 miles from the east end; the second was 13 miles from the west end.

Everything worked according to expectations, except that the thickness of asphalt pavement as finally laid was somewhat greater than the 2-inch theoretical amount shown on the plans. This was due to the lightness of material, which failed to check with the specified tonnage shown on the plans. The Pioneer plant, averaging 170 tph in material of average moisture, was literally snowing under the laydown machine, because 170 tons an hour in the light material represented an enormous stream of hot-mix emanating from the pugmill.

Several problems dogged the paving operation. The light aggregates were none too dry and the volume the plant needed was high. In order to boost dryer capacity by a moderate amount to hit the high tonnage required, a small secondary dryer was set in the line just ahead of the Pioneer dryer to eliminate a first stage of moisture. It was estimated that the initial dryer removed about 2 per cent from 8 per cent material, and the remaining moisture was then removed by the big single dryer on the Continuflo plant.

Since the job was also in a remote section, the asphalt haul was long. The 250-300 penetration asphaltic cement used in the mix was trucked south from Carter Oil Company's Billings refinery. Centered at the hot plant was 20,000 gallons of hot asphalt storage. The tanks were maintained at near-full capacity so that in a 24-hour emergency the big plant could continue operating until asphalt deliveries resumed. There was also about 5,000 gallons of diesel fuel storage for the supply of the plant's steam generator,

● This asphalt lay down machine, working in high country on the east end, exemplifies placement methods used by all the contractors.

and about 2,300 gallons of gasoline storage.

Further to assure dependability, the Pioneer plant was electrically driven with power supplied by its own General Motors diesel-electric generating plant. This freed the plant from depending on any other source of power. The auxiliary dryer was driven by an independent diesel engine.

An electrically driven, low pressure Ray burning system was used in the Pioneer dryer. It made possible the occasional operation of the dryer at an excess of its rated capacity. Some 200-mesh material was rejected at the screens, while some fines were blown directly out the stack. This brought the content of that material down to a point where it would meet specifications.

Two Sets of Specs

There were two sets of specifications governing the 38-mile job. A single bin pull was permitted on the first two contracts in Richardson's job, while a double bin pull was necessary on the third. Accurate gradation of material was achieved in either case by separating and sizing the aggregate on the Pioneer plant's screen deck.

It took as many as 18 trucks to keep the plant output hauled to the paver. Both plant sites were within a quarter mile of the highway, so truck haul conditions were good. The asphalt paving was laid in a single-thickness course, 12 ft. wide, by conventional methods. Up to one mile of completed 24-ft. highway pavement was laid in a day using a single Barber-Greene machine. Favorable autumn weather made it possible to develop optimum compaction by a knockdown roll with a Galion 5-8 ton machine, and the finish roll was then applied by a Galion 8-12 ton steel wheel roller.

The hot plant move to the second site was made with split second timing after a Saturday evening (5:30 p.m.) shutdown. On Tuesday morning at 8 a.m. the plant was again set up, the asphalt tanks were hot, and the first batch of hot stuff was hitting a truck bed.

Moreover, the job was finished, so far as paving was concerned, just before winter's onset. Good organization, good equipment, and excellent cooperation between the contractor's crews and Montana engineers had paid off. Undoubtedly the new highway between Crow Agency and Broadus will become one of most used in Montana.

Scott P. Hart, State Highway Engineer of the Montana State Highway Department, was in charge of the general supervision of the job, with inspectors and the resident engineer based at Ashland.

● Cedarapids Master Tandem aggregate plant was set up on the extreme west end.

● Bros pneumatic rollers pulled by Minneapolis-Moline rubber tire tractors compact the granular base behind a Caterpillar No. 12 motor grader.

Sprinkling can best for crack sealing

By J. M. Rexroat

Senior Maintenance Foreman

Texas Highway Department
District 2, Fort Worth

("Texas Highways," employee publication of the Texas Highway Department.)

Sealing surface cracks with the hand-spray method has caused considerable concern for a long time due in the main to lack of control of the application of the asphalt. This excessive asphalt generally encountered consequently causes a build-up of the cover material, thus creating an unsightly as well as a rough riding surface.

Numerous ideas and theories have been advanced, but we believe an inexpensive two-gallon water sprinkler (modified with sprinkler head removed) is our best solution to this problem at present. The spray nozzle head is removed and the container then used most effectively and efficiently merely as a pouring bucket. The small outlet on this container controls the flow of asphalt and also enables us to follow the course of the cracks better.

Blow-sand is then applied by hand shovel to the asphalt-filled crack, thus providing sealed surface cracks with a smoother riding surface then experienced from the hand-spray method.

This method of sealing cracks, incidentally, enables us to accomplish about twice as much work as the hand-spray method mentioned in this article.

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VIEWS AND COMMENTS

What Are Flexible Surfaces?

By H. G. Nevitt

OUR readers are referred to the lengthy letter by Mr. Sievert published in last month's ROADS & STREETS concerning our December discussion entitled "Flexible Surfaces Must Be Flexible". They will find it both instructive and provocative.

Mr. Sievert feels that he is in disagreement with us; actually we can wholeheartedly endorse the great bulk of his remarks. He has described, in an outstandingly able as well as appealing fashion, the benefits offered by the bituminous type of surfacing. He has likewise visualized the needs in the highways of the future. Except in some minor ways our views do not conflict with Mr. Sievert's; we do need to clarify in his mind the precise meaning attached to the term "flexible surface" and exactly how we think it functions. We hope both his letter and these remarks will arouse such interest in the reader's mind that he will carefully follow the distinctions outlined in the following. They may seem small but they are extremely important. Unless we know exactly what we are aiming for in a modern bituminous pavement, we may end up by not building it and will obtain in certain cases the roads which Mr. Sievert correctly thinks we should avoid.

We need to first discuss the term "flexible surface". As a description of a certain type of road (involving not merely the surfacing but likewise the base) it has attained common usage. We certainly did not propose it, and only adopted it in discussing these structures due to this previous general acceptance, along with the lack of a more accurately descriptive name. It can best be defined by saying what it is not. First of all, it is not a "rigid pavement". Such have flexibility but it is an elastic flexibility, meaning a practically complete return to the original condition, regardless of what happened to the base, when the load is removed. Neither is it a plastic surface. This has little or no elastic return upon load removal, but continuously deforms with successive loadings, such deformation being accompanied by negligible further consolidation and likewise negligible increase in resistance as the same load conditions are repeated. Mr. Sievert tells about pavement showing shove humps, and exhibiting appreciable horizontal deformation; these are not flexible surfaces (or bases) but rather plastic ones. Plastic surfaces are definitely to be avoided. The development of plasticity may not be the worse type of failure encountered with poorly constructed bases or bituminous surfacings, but it is a very undesirable one.

Follows Definite Rules

The flexible surface is one in which there can be permanent deflections with repeated loading, but these follow certain very definite rules. First of all, the load must exceed some limit before any portion of the deflection persists after load removal. When final settlement of the base, along with sufficient consolidation and adjustment of the surface to it has been reached, this limit will correspond to the maximum load and there will be no further permanent deflection. However, as long as the base does move and the pavement consequently lacks the intended or designed support, it will adjust through the incremental deflections described in our previous article until this condition is again reached. During the adjustment period both the pavement and the base are consolidating.

Whether the ultimate result is a rough, uneven surface is purely a matter of design and construction, primarily the latter. If the base has been poorly built and not given sufficient consolidation, it may settle so as to provide a rough surface; the pavement must necessarily then adjust itself to the same undesirable contour.

A common example of this is seen on roads — particularly those with considerable fills — where the construction (and compaction) are unsatisfactory, so that the initially smooth subgrade and/or foundation course when subjected to later traffic compaction ends up with a rough and irregular surface. The pavement, smooth when laid on the originally smooth surface, will of course end up with the same undesirable roughness, but this should not be blamed on its flexibility. In fact, were it not flexible it would have cracked and disintegrated due to inability to adjust itself to the final irregular surface adopted by the base. Any roughness not due to the above effects comes from plasticity in the pavement. We have specifically opposed design or construction procedures which would result in plastic surfaces; they are not flexible pavements as defined commonly, or discussed in our previous article.

The whole secret here is that the action of the flexible pavement and/or the flexible base with the successive loadings must result in decreasing increments of compaction until equilibrium is reached. With proper construction this will occur uniformly, with the result that the smoothness of the original construction is practically maintained in the final compacted structure. Obviously, the safest way to achieve this is by sufficient initial compaction of the base, followed by similar compaction of the foundation course (when used) and finished pavement layers to assure negligible further densification under traffic, with the threat of increasing roughness that this carries. The need is just as great with bases under rigid pavements as it is for those supporting bituminous surfaces.

In brief, we can have exactly the type of modern road Mr. Sievert desires, suitable for the highest traffic counts, yet with the pavement functioning as we previously described and meeting the definition of the so-called flexible road. The mere fact that these modern pavements, given the careful design and construction which Mr. Sievert also correctly advocates, do not seem to act as we outlined because the successive increments of compaction from traffic are so small — or are negligible because equilibrium has been reached in the construction — in no way obviates the need for such type of surface. Its merit is that it can adjust itself to obtain the full bearing power of the supporting layers underneath regardless of the adjustment required.

It is merely a matter of good construction practice that in doing so we end up with a surface of high riding quality. That this can be done is evi-

denced everywhere, although we recommend more attention to this matter of smoothness by a program such as is used by Minnesota to constantly provide information concerning it. We definitely should not build plastic surfaces. Nor should there be too much roughness in light traffic structures, even though traffic compaction in such cases, to save construction costs, is a practical and desirable procedure under certain circumstances. Such a program should involve stage construction, so that the roughness sometimes accompanying such traffic settlement need be endured only long enough to get the desired density, when it is eliminated by a properly placed finishing course which also serves to level out or smooth the final surface.

Except in minor fashion in the points later discussed, it can be seen that Mr. Sievert is in complete accord with us. He wants no plastic surfaces; we specifically stated in our previous discussion that they were as undesirable as surfaces which could not be described as flexible because of too much rigidity. He wants the modern road to be smooth, he wants the modern road to be high in traffic capacity as well as to give foremost service; we thoroughly agree and believe that this is only a matter of building the so-called flexible surface properly. In brief, we both wish to get the numerous advantages he so vividly portrays, and which account for the large proportion of our mileage built with structures of the so-called flexible type.

Several Discussion Points

We would like to remark on some specific points raised in either the above discussion or in Mr. Sievert's letter, as follows.

1. It should be noted that the term "rigid pavement" is a relative one. There are practically no completely elastic nor completely rigid materials in actual construction use — that is, materials which do not show some permanent deformation under repeated loadings in time. Portland cement slabs exhibit such deformation to some extent; it is probably an advantage, because the air-intrained concrete that is now getting popular greatly increases this tendency. Skeptics may point to steel as a truly elastic material if the stress is below the elastic limit. However, they will find that this is a matter of degree. We hesitate to tread in deep water, but we believe the only completely elastic materials are isolated or individual crystals, showing an uninterrupted crystal lattice. Materials made up of individual crystal grains (such as the metals) have boundary planes between the crystals of anomalous characteristics. We refer anyone interested to modern metallurgical explorations on the effects of such boundary plane characteristics on the metal strength.

Rigidity is therefore relative, although the permanent deflections involved with many materials are infinitesimal and therefore negligible in practice. Plasticity is almost never desired. The difference between the so-called rigid slabs and flexible pavements is merely the degree in practice to which they exhibit adjustment to the supporting structure. Such adjustment is highly desirable, both in the supporting structure as well as in the surface. The post-construction densification of both should be eliminated or controlled to avoid excessive shape changes.

2. In modern bituminous construction, due to the design, ample construction compaction, and similar, the magnitude of the further densification and permanent deflections under traffic is extremely small. Even to the experienced engineer it may appear that they do not occur, or that equilibrium is reached in a short time. Actually, in our personal studies of the compaction of bituminous mixes, including crushed aggregate or otherwise of high quality, we have never encountered a condition where the measured densification had ceased. Since the increments decrease as compaction progresses the amount of change might become exceedingly minute; but in every case it followed the mathematical trend established in the preceding compaction, with no evidence that the eventual equilibrium to be anticipated had been reached or was being approached. From the practical standpoint of appearance and action under traffic these mats were stable and permanent; scientifically, the action described in December was still continuing, though at an infinitesimally small rate.

3. Mr. Sievert describes the ideal bituminous pavement as one in which the load is carried by the base, with the paving providing only a wearing surface. We agree that in practice the original wearing surface should be built to minimum thickness, which means that the base must do most of the load carrying, for reasons of both initial economy and because in any upgrading of the support value to meet future needs the result will probably be a thickened surface. This will then have the proper relationship to the total structure to give the most economical distribution of support strength by the various components of the structure. This wearing surface, no matter how thin, should also provide such support as its thickness will permit. The support increase thus assured is well worth striving for, even though the original base design should certainly be ample and not be the cause of either failure or excessive deflections from the applied loads.

4. We heartily concur with Mr. Sievert's comment that asphalt can no longer be considered a secondary material. Properly used, its relative merits increase as the loadings and other factors of design increase. The heaviest vehicle loadings we encounter today, exemplified by tanks and large planes, demonstrate as much or more economy through the use of asphalt in a suitable design as do those normal for our highways.

5. Mr. Sievert mentions "that certain over-asphalted dynamic load pavements" have proven satisfactory under trucks. We wonder how these pavements could have been over-asphalted if they have proven satisfactory under our heaviest highway loadings. Perhaps the base conditions were such that complete construction compaction — at least at the time the roads were built — could not be obtained and it was therefore desirable to resort to a design which permitted full later adjustment, though without plasticity. If so, we wonder why this was not a good procedure, since a leveling overlay, to which (as Mr. Sievert points out) asphalt surfaces are so readily adapted, would have in due course provided smoothness for the completely compacted structure.

6. Mr. Sievert mentions graduated base design, carefully controlled density, ideally graded bituminous concrete of maximum support value, and other points which are fundamental to the best modern bituminous design. We want to emphatically endorse these features; but we maintain that they improve, but do not change, the basic action of a flexible pavement, where as the sacrifice of this flexibility (as defined) will in due course cause trouble.

Illinois Tech leads schools

Illinois Institute of Technology in Chicago is No. 1 among the nation's institutions in engineering student enrollment, with 5,178 undergraduate and 502 graduate students; 5,680 total. Other leaders, according to a summary from IIT: Purdue University, 4,906; City College of New York, 4,887; University of Illinois, 4,826; Brooklyn Polytechnic, 4,668; Georgia School of Technology, 4,016; Pennsylvania State, 3,709; Massachusetts Institute of Technology, 3,609; University of Cincinnati, 3,359.

● New executive offices and laboratories of The Asphalt Institute at College Park, Maryland, where the Institute has moved after 35 years in New York City.

Hayes heads U.S. hot mix group

Sheldon G. Hayes, head of the Cadillac Asphalt Paving Co., Detroit, was elected as the first president of the National Bituminous Concrete Association recently.

Other officers are Bryand M. Collins, Austin, Texas, vice president, and Allen Snyder, Garwood, N.J., secretary-treasurer.

Headquarters for the new association of hot mix asphalt paving contractors will be in Washington, D.C. An executive director will be appointed as soon as offices are established.

A tentative constitution and bylaws were adopted at the meeting, which was attended by about 100 delegates from 16 states. The purpose of the organization is to promote and further the use of bituminous concrete pavements, stimulate research and development of high type asphalt paving, to act as a central agency for distribution of information to the membership, and to develop educational and promotional programs.

Nine regions were established for representation on the Board of Directors. A Board of Governors will have one member from each state. Elected were:

Board of Directors: Paul R. Anderson, Charleston, W. Va., Chairman; C. H. Thomas, Taunton, Mass.; Harlan Conly, Norristown, Pa.; R. L. Smith, Charlotte, N. C.; Donald O. White, Chicago, Ill.; Bryand Collins, Austin, Texas; George A. McPherson, Fairmont, Minn.; D. L. Cheney, Seattle, Wash.; H. E. Schroeder, Sun Valley, Calif.

Board of Governors: California — H. E. Schroeder, Sun Valley; Illinois — Leo O'Neil, Champaign; Indiana — Lee Rieth, South Bend; Massachusetts — C. H. Thomas, Taunton; Michigan — B. E. Lathrop, Kalamazoo; Minnesota — Stanley Watkins, Minneapolis; Maryland — J. Russell Schultz, Towson; Missouri — Howard Bridges, St. Louis; New Jersey — George J. Landers, Newark; North Carolina — Robert L. Smith, Charlotte; Ohio — Frank Longabaugh, Columbus; Pennsylvania — Harlan Conly, Norristown; Texas — S. W. Gayloard, Houston; West Virginia — Paul R. Anderson, Charleston; Washington — D. L. Cheney, Seattle.

Asphalt Institute Dedicates Maryland Headquarters

AT College Park, Maryland, on May 5, a 28-man paving crew surfaced 1,100 sq. yds. of roadway in 24½ minutes in a speed paving demonstration. This stunt highlighted the dedication of the new Asphalt Institute offices and laboratories on the University of Maryland campus.

At the same time, more than 500 guests gathered in the university armory to hear former Congressman Jennings Randolph of West Virginia call for a major national highway overhaul to accommodate an anticipated 90,000,000 cars that will be on the road by 1975.

Randolph was the principal speaker at the formal exercises which saw Judge William P. Cole Jr., chairman of the Board of Regents of the University of Maryland, turn over the handsome new Georgian building to President J. E. Buchanan of The Asphalt Institute. President Wilson H. Elkins of the university presided at the afternoon ceremony.

A fleet of 14 laden trucks, two asphalt spreaders and two rollers then proceeded with the "whirlwind" paving of a 393-ft. stretch of 24-ft. road in front of the Institute Building. The crew from the Corson and Gruman Co., contractors of Washington, D.C., performed the work.

The long-range industry program of the Institute, and its research and testing facilities, were also outlined.

A. S. Wellborn, chief engineer, told of the organization's rapid growth and the need for an expanded research and engineering program. The new facilities at College Park will be devoted to a three-point program of research, engineering and education. While highway pavement will be the chief subject, the application of asphalt in hydraulic structures, shore erosion prevention, railroad work and in other engineering fields will be covered.

The facilities themselves were described in detail by John M. Griffith, the Institute's engineer of research. These include a complete array of Standard testing equipment such as heating and drying ovens, compaction machines of all types, aggregate heating ovens, laboratory mixers, stability and flow test equipment and related apparatus — perhaps the most complete laboratory of its kind anywhere.

The Institute serves asphalt users through 21 field offices.

NEW!

TRAIL-O-PATCHER

Bituminous Mixer

7 ton hot / 12 ton cold } capacity

The first self-contained, all-in-one, all-weather bituminous mixer. It's the first all-day mixer, thanks to its huge 200-gallon asphalt tank. Has its own bitumen metering system and aggregate drying compartment. Does such a thorough mixing job, it's practically dust-proof.

Littleford designed, engineered and built, the new Trail-O-Patcher is your most practical answer to the rising cost of road maintenance. Send today for bulletin 28.

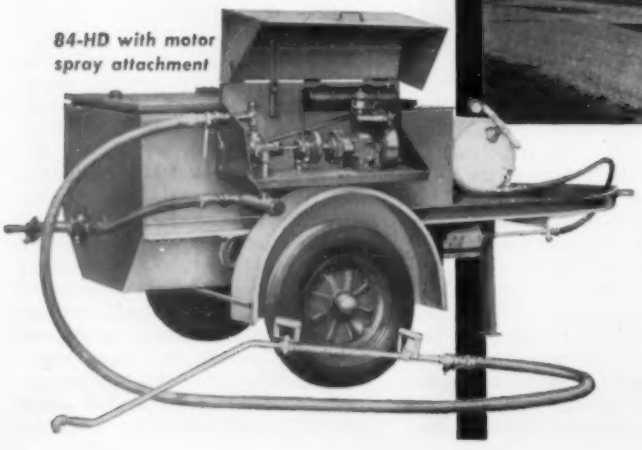
LITTLEFORD

paves the way for lower cost

84 HD Tar and Asphalt Kettles

cuts costs automatically

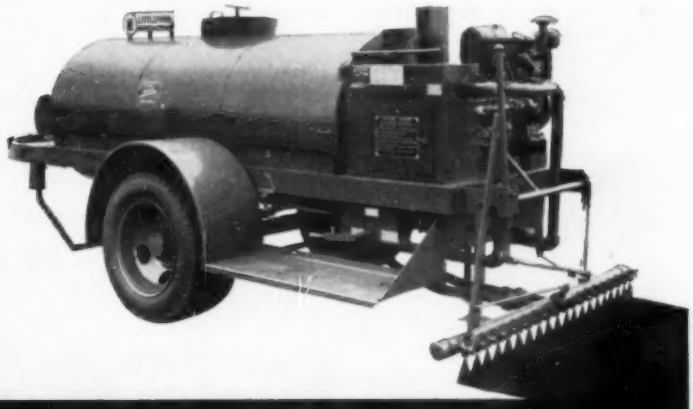
84-HD with motor spray attachment



You get more "hot stuff" faster, at lower cost and with greater safety with the Littleford 84 HD tar and asphalt kettles. Made in 3 models—standard, with hand spray attachment, and with motor spray attachment—there's a type for all your requirements. For complete information on the most efficient kettle money can buy, send for Littleford bulletin X-1.

101 UTILITY SPRAY TANK!

Single unit does any kind of patchwork. The Littleford 101 comes equipped with (1) a circulating spray bar up to 10-ft. wide for small application jobs . . . (2) a hand spray attachment for patching by hand . . . and (3) there's an outlet for filling pouring pots for small crack and joint filling. Get the facts before you buy . . . send for bulletin 5.



Your choice of mountings: Truck mounted type (above), 2-wheel trailer (right), or 4-wheel trailer. Wider choice, better buy!

ROAD EQUIPMENT

road construction and maintenance

BITUMINOUS SUPPLY TANK 102

Littleford supply tanks are your most efficient means of hauling hot or cold bituminous materials from the source to your Littleford Bituminous Distributors, Trail-O-Distributors, stationary or traveling mixing plants, bulk storage or asphalt mixing machines. Model 102 shown below. For complete information, write for bulletin 25.

BITUMINOUS SUPPLY TANK 103

Littleford engineered and quality built, these tanks will last for years, cost you less to own and operate. Model 103 tandem axle design shown above.

Equipment with BUILT-IN ENGINEERING LITTLEFORD

LB LITTLEFORD

BLACK TOP ROAD MAINTENANCE EQUIPMENT SINCE · 1900

LITTLEFORD BROS., INC.
454 E. Pearl St., Cincinnati 2, Ohio

. . . for more details circle 216, page 16

What's New
in Equipment and Materials

Reader Service Coupon on Page 16, more items pages 124-129

Coating Seals and Protects Asphalt Surface

A new tar-base coating said to provide highly effective protection against deterioration of any asphalt surface has been developed by Bitucote Products Co., St. Louis 10, Mo. Known as Tarcote, the material, when applied to asphalt areas, is stated to check the destructive effects of frost action, actinic rays of the sun, oxidation, acids, salts, alkalies and petroleum products.

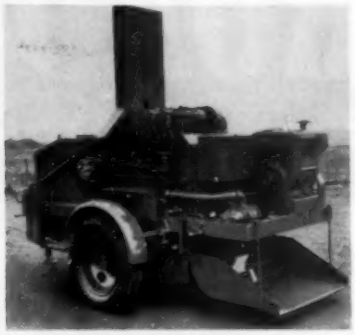
Tarcote is applied cold, with brush, squeegee or heavy duty spraying equipment. It contains no solvents or harmful toxic ingredients, and can be applied directly from the container, with no additives or mixing required. Tarcote is recommended by the manufacturer as a protective coating for parking lots, driveways, play areas, drive-ins, service stations, runways, platforms, tennis courts and other black-top areas.

For more information circle 149 on Service Coupon Page 16 and mail now.

All Weather Bituminous Mixer

A new bituminous mixer, the Model 700 Trail-O-Patcher, has been announced by Littleford Bros., Inc., 454 E. Pearl St., Cincinnati 2, O. The Trail-O-Patcher has a capacity of 7 ton of hot mix and 12 ton of cold mix. Requires no special equipment to do the bituminous mixing job — it is self-contained. Has its own bitumen metering system, its own aggregate drying compartment and its own heated 200 gal. bitumen tank. The Trail-O-Patcher has twin pugmills, heat insulated with a drying capacity of a rotary dryer 24 in. dia. x 84 in. long. Dryer also eliminates dust nuisance. Controls are fool-proof, positive acting, conveniently grouped and accessible.

Model 700 Trail-O-Patcher has hand spray attachment for applying bituminous material, flame deflector gate, permits mixing out of the presence of flame, high speed trailer, adjustable front leg, exhaust stack hinged to facilitate storage and large discharge pan holds 7 cu. ft. of material. The Trail-O-Patcher is an all-weather mixer. Will mix in any kind of weather and is designed for maintenance and repair work on roads, streets, highways, parking areas, runways and driveways.



Model 700 Trail-O-Patcher

For more information circle 150 on Service Coupon Page 16 and mail now.

Truck-Mount Asphalt Mixer

A new McConnaughay HTB truck-mount asphalt mixer, designed for fast, low cost patching, has been announced by K. E. McConnaughay, Lafayette, Ind. This new asphalt mixer can be quickly mounted on the rear of any standard dump truck, and just as quickly removed. This model handles up to 5 tons hot mix or 10 tons cold mix per hour. When mounted on a dump truck, the mixer is easy to maneuver into any position, easy to move from one location to another, and permits a small crew to haul, mix and lay asphalt with one unit. Width of mixer — 6 ft.; depth with shoveling tray up to 2 ft. 6 in.; depth with tray in working position — 4 ft.; height, not including stack — 4 ft.; height with stack — 7 ft.; weight — 1160 lb. McConnaughay

Wolverine Contractors know how to get more work out of equipment—use STANOLUBE HD-M *Motor Oil*

Norris Host (right), President of Wolverine Contractors, Inc., and Robert Larsen, Standard Oil automotive lubrication specialist, talk lubrication on job site. Customers of Bob's like to talk lubrication with him. They know it can pay off *for them* in better, lower cost operation of equipment. Bob's seven years' service with Standard Oil gives him a solid background of experience for this sort of work.

Wolverine Contractors, Inc., Detroit, know that good maintenance begins with good motor oil. They have used STANOLUBE HD-M Motor Oil for many years in both gasoline and diesel equipment. On overhauls, engines come down clean and free of sludge. These are the reasons STANOLUBE HD-M delivers this clean, sludge-free performance:

1	STANOLUBE HD-M Motor Oil is refined from high quality base stock.
2	Additives exclusive with STANOLUBE HD-M retard oxidation of the oil, reduce formation of piston and ring belt deposits.
3	These additives in STANOLUBE HD-M prevent fuel from forming varnish and sludge.

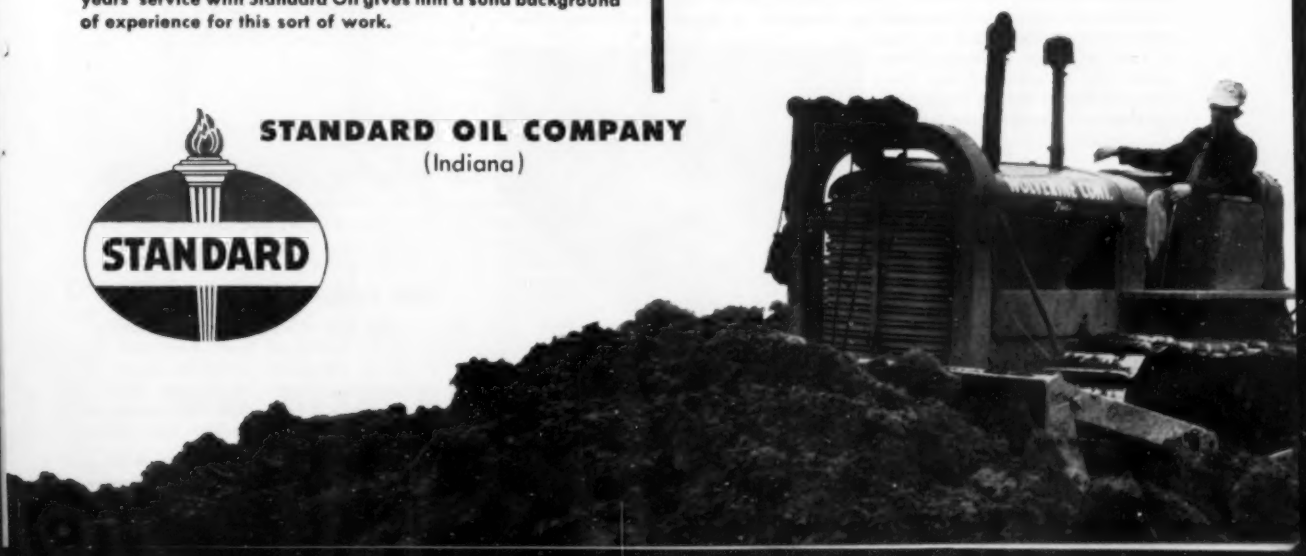
STANOLUBE HD-M makes the maintenance job easier for maintenance men by: extending periods between overhaul; making the overhaul job easier when it is done; reducing wear and eliminating corrosion of bearing metals. STANOLUBE HD-M Motor Oil makes the construction job more profitable for the contractor by helping him get more operating hours out of equipment.

Get the facts about STANOLUBE HD-M Motor Oil. Get in touch with your Standard Oil automotive engineer. In the Midwest call your nearby Standard Oil office. Or contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY
(Indiana)

STANDARD

Dozer helps with grading on Wolverine Contractor project. As with all equipment Wolverine operates, this dozer gets Standard Oil lubrication exclusively.



HTD-B Truck Mount Asphalt Mixer

asphalt mixers are sold through the Asphalt Equipment Co., Inc., Fort Wayne, Ind., national distributors for K. E. McConnaughay, Lafayette, Ind.

For more information circle 151 on Service Coupon Page 16 and mail now.

Simplex Bin and Batcher

As a further step in their policy of standardization and simplification of their complete bin and batching equipment set-up, Construction Machinery Sales Co., Waterloo, Iowa, has announced the new Simplex combination. Simplex is available in 47 or 49 ton capacity with two, three or four compartments, with or without separate cement. Advantages claimed for the new Simplex include: there are only a few pieces to assemble when erecting, including interchangeable legs; equipped with radial aggregate charging gates; dual rubber pinch cement charging gates; combination clam and rubber pinch discharge gate.

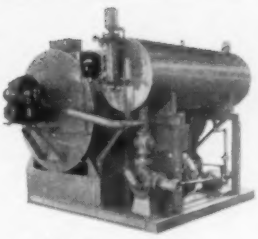
New Simplex Bin and Batcher

For more information circle 152 on Service Coupon Page 16 and mail now.

New Design for Utility Sprayer

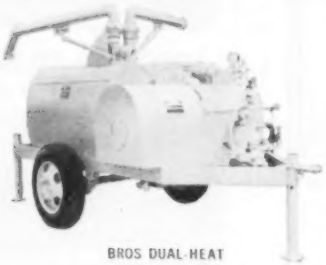
Model 101 utility spray tank manufactured by Littleford Bros., Inc., 454 E. Pearl St., Cincinnati 2, O., has been redesigned to incorporate features for efficient spraying of asphalt, tar, emulsions, cut back or road oils. The 101 utility

BROS SELF-PROPELLED ROLLER

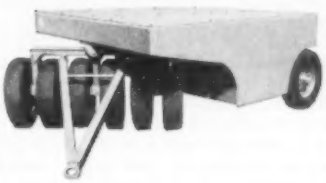


BROS HOT OIL HEATER

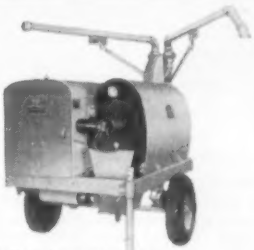
BROS 100-TON ROLL-O-PACTOR



BROS DUAL-HEAT



BROS 13-TON ROLLER



BROS CIRCULATOR & HEATER

Why settle for less than the Best?

BROS

Compaction Equipment

Self-Propelled Roller for seal coat, resurfacing and standard lift compaction jobs. Oscillation of all wheel pairs and 50 hp engine in this new BROS roller provide more tractive effort than any comparable roller. Torque converter drive, shuttle 3-speed transmission and high angle turn-around provide faster, surer handling.

35, 50 and 100-ton Rollers for "super-load" compaction. Big jobs like air fields, dams and super highways reach required compaction densities in fewer passes by these pioneers of *deep* compaction — giant BROS Roll-O-Pactors. Work in speeds up to 15 mph.

9 and 13-ton Rollers for base course compaction. These models are available in either straight wheel or the Wobble-Wheel design . . . which adds side-to-side weaving motion to the up and down oscillating axle motion of each wheel. Overlap of wide face tires actually provide full coverage in one pass.

Sheepsfoot and Diamondfoot Tamping Rollers for heavy earth work on embankments, etc. Models available from 2½ to 15½ tons when loaded with ballast. Special relief shank of feet provide easier withdrawal from clayey soils. Worn tips are easily replaced right on the job — *without welding*—by patented removable Tamprite tips.

BROS

Bituminous Equipment

Hot Oil Heater for asphalt circulation. This recent addition to the BROS Bituminous line transfers heat 60 per cent faster than steam when used with proper accessory equipment. Keeps heating oil moving fast under accurate control at all times. It's the finest entirely automatic unit available; performance output is governed by the turning of a knob.

Asphalt Circulator and Heater for high temperature asphalt heating and pumping beyond the range of steam. It has 4 distinct pumping speeds and wide heat transfer range. It raises temperature of 10,000 gals. of asphalt 40 to 50 degrees per hour after circulation starts. Semi-trailer and skid-mounted units available.

Dual-Heat for asphalt heating, circulating and pumping. A favorite with state highway departments, it quickly provides hot dry steam to "crack" hard-to-start bitumens of all grades. It can unload one car while heating another. Peak efficiency and positive operation under any job conditions.

For complete information on these products, see your nearest Bros distributor or write for literature. Then you'll readily understand why BROS IS THE BEST!

ROAD MACHINERY DIVISION

WM. BROS BOILER & MANUFACTURING CO.

1057 Tenth Avenue S.E. — Minneapolis 14, Minnesota

. . . for more details circle 252, page 16

Model 101 Utility Spray Tank

spray tank now has an improved mechanical type circulating spray bar, with positive acting nozzles. It is possible to spray with either half of the new bar or any desired length of bar. The new spray bar can be furnished both in the shifting and non-shifting type. The shifting type also includes a raising and lowering feature.

Model 101 combines three units in one — has the full circulating spray bar up to 12 ft. in width, for small application jobs, hand spray attachment for patch work and a pouring pot outlet for crack filling and patch work. Model 101 has two Littleford tank type burners, heat chamber for pump and valves, 16 in. x 22 in. manhole, 8 HP engine and 100 gal. pump. Model 101 is made in two wheel trailer models 400 and 600 gal. sizes. Four wheel trailer sizes up to 1,250 gal. and truck mounted sizes up to 1,000 gal. This improved model is stated to combine the latest in low cost operating features.

For more information circle 153 on Service Coupon Page 16 and mail now.

Tractor-Shovels Have Exclusive Design Features

The introduction of two entirely different four-wheel-drive models to their line of "Payloader" tractor-shovels has been announced by The Frank G. Hough Co., 768 Seventh St., Libertyville, Ill. These new machines are the Model HU, with a 1 cu. yd. heaped-capacity and the HH, with a 1½ cu. yd. heaped capacity.

Outstanding among the features of these new models is the design which permits 40 degrees of bucket "breakout" at ground level rather than at a three or four foot "carry" position, according to the manufacturer. Furthermore, to obtain maximum loads with a minimum of effort, a powerful "pry-out" action is accomplished by using breakout pads on the ground as a fulcrum for leverage. The opposing load forces are thus transferred to the ground through the pads during the "breakout" instead of to the axle, wheels and hydraulic system of the machine. These are exclusive, patented features.

A combination of underslung boom-

Models HU and HH Payloader Tractor-Shovel

arm design and positioning provides complete driver visibility and safety. The need for safety guards or screens to protect the driver from the boom-arms has been eliminated. Other features common to both new "Payloader" units include sealed, pressurized hydraulic systems; 12-volt battery systems on the gas-powered units with battery box and hydraulic oil reservoir mounted behind the driver's seat for easy accessibility. Torque converters and full reversing transmissions; double-acting hydraulic rams with chrome-plated piston rods; hydraulic brakes and power steering are standard on both models and load-shock accumulator devices are optional.

For more information circle 154 on Service Coupon Page 16 and mail now.

Rubber-Tired Self-Propelled Crane

A self-propelled, one-man operated, rubber-tired utility crane has been introduced by Link-Belt Speeder Corporation, Cedar Rapids, Iowa. Designated as the UC-68, with 15 tons lifting capacity, the crane is an addition to the broad line of Link-Belt Speeder crawler and rubber-tired shovel-cranes manufactured at Cedar Rapids, Iowa. Like all new machines now built by this manufacturer, UC-68 features Link-Belt Speeder exclusive Speed-O-Matic, the true power hydraulic control system.

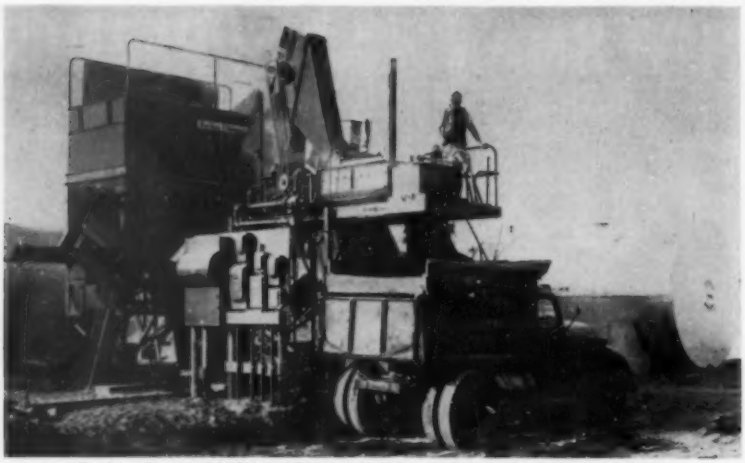
The UC-68 is equipped with an independent boom hoist which provides power controlled raising or lowering of the boom. Booming up is friction clutch driven, while booming down is mechanically controlled by a ratchet and pawl mechanism against engine compression or a boom hoist lowering clutch is available for precision control. Two important work-speeding optional features are — reversing clutches for either or both main drums, and independent swing and travel. The former provides power controlled load lowering of either load line — simultaneously or independent of each other. The latter allows the machine to combine the swing and travel operations.

New UC-68 Utility Crane with Shovel Attachment

For more information circle 155 on Service Coupon Page 16 and mail now.

Versatile Asphalt Plant in 20-50 TPH Range

Versatility is an important feature of the new 20-50 ton per hour range model 840-B asphalt plant series of Barber-Greene Co., 400 N. Highland Ave., Aurora, Ill. The true picture of this versatility may be found by considering the



Barber-Greene Model 840B Asphalt Plant with Capacity of 20-50 TPH

basic plant unit; the mixer. Just the pugmill section of the mixer may be obtained and mounted permanently for the production of stabilized mixes. However, if portability is desired, the complete mixer, with rubber tire mounting and adjustable jacklegs may also be used for the same function. For emulsions, or other cold-mix bituminous materials, or for stabilization work where accurate proportioning of aggregate and binder is desired, the mixer may be fed by a conveyor, a crane or a front-end loader. The apron feeder in the hopper is equipped with an adjustable, calibrated gate. It is mechanically interlocked with the asphalt pump on the mixer for positive and consistent proportioning of the ingredients. Capacities in this set-up often exceed 50 tons per hour.

For the production of hot mixes, the same mixer-hopper combination is employed and a Barber-Greene portable dryer is added to dry the aggregate and bring it up to proper mixing temperature. Either of two dryers may be used, depending upon tonnage requirements. One offers 10 to 25 ton per hour output; the other 30 to 45 tons per hour. Both are equipped with built-in dust collector cones for fines conservation and are also equipped with built-in bucket elevators for feeding the dryer and discharge to the mixer. Like the mixer, both have jackleg supports and both are rubber tire mounted for portability. When two, or three bin screening and separation of the aggregate sizes after drying is required, a Barber-Greene portable gradation control unit is interposed between the dryer and the mixer. In such an installation, the single-aggregate hopper and feeder are removed. The apron feeders on the gradation control unit which provide accurate proportioning of the aggregate, are mechanically interlocked with the asphalt pump on the mixer. Each bin of the gradation control unit is equipped with a separate, adjustable, calibrated gate. Once the aggregate proportions have been established, each gate is set and locked and the mix proportions remain constant. A fourth bin may also be added if needed. Capacities in this multiple aggregate set-up reach 40 TPH.

Complete cold aggregate feed systems are obtainable for either the single or multiple aggregate setups. These systems include portable two, three and four bin hopper units. Each hopper is equipped with a separate adjustable gate.

For more information circle 156 on Service Coupon Page 16 and mail now.

Pump and Valve Combination For Hoists

A new, high capacity, roller bearing hydraulic pump and 3-position spool valve combination designed for use with Duo-scopic hoists has been announced

L. J. Dampprope hand-sprays corner of road being oiled.

Operates four Etnyres—2 to 29 years young!

One-man operation . . . nozzles that stay freer . . . and a good pump near the job . . . are three main reasons why "Etnyres are the best we ever had" in the opinion of Marvin F. Borgelt, Treasurer, Bituminous Surface Treating Co. of Minneapolis, Minnesota.

Four Etnyres are in the fleet, ranging in age from two to twenty-nine years. On the unit shown above, no maintenance due to failure of the unit has been necessary. Air controls in the cab make possible one-man operation.

Mr. Borgelt points out that Etnyre has a dependable pump located under the tank, forcing material under constant pressure to the spray bar with an even, nonpulsating flow. Among other features, he points to easy loading, simplified draining, easy-to-start engines, efficient handling of all types of materials, good performance on any type of terrain, plus prompt service when needed from the Etnyre factory organization.

Now is the time for you to investigate Etnyre "Black-Toppers" for better results at lower cost. See your Etnyre dealer or write E. D.Etnyre & Co., Oregon, Illinois, U.S.A.

SEE YOUR ETNYRE DEALER

ETNYRE

"Black-Topper"

BITUMINOUS DISTRIBUTORS

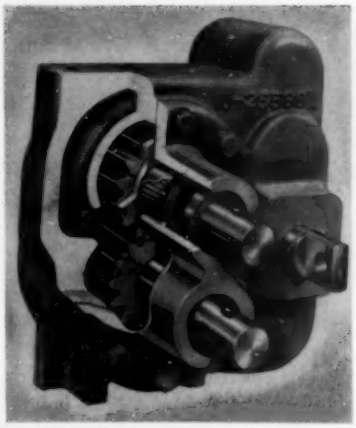
. . . for more details circle 184, page 16

by The Galion Allsteel Body Co., Galion, O. Developed to provide the large volume of high pressure oil necessary for fast operation of telescopic hoists, the new pump and valve combination is stated to afford compact, easier mounting and decreases the number of necessary hydraulic lines and connections. According to the manufacturer, maximum oil flow and fast hoist operation are assured by the large 1¼ in. diameter spool valve, plus oversize oil passages throughout the pump and valve housing. A 1¼ in. oil supply line between pump and reservoir is said to prevent cavitation during fast raising.

A cartridge-type pressure relief valve, which can be replaced as a complete unit, is located in the valve housing. Galion relief valves are factory calibrated to correct pressure and can be easily replaced in the field, using ordinary hand tools. "O" ring seals are used throughout the valve. A steel ball check in the high pressure line prevents back-flow through the pump and, it is said, keeps the hydraulic system free of air. The reversible rotation gear-type pump is fitted with bronze wear plates and special spring-loaded shaft seals.

The new high volume pump and valve combination is now available for use with all Galion Duo-scopic hoists, trailer dumps and high capacity cylinder type hoists.

For more information circle 137 on Service Coupon Page 16 and mail now.



Cutaway of Pump Showing Roller Bearings, Shaft Seals, Wear Plates and Large Oil Passages

All-Steel, Multi-Purpose Barrier

A new, all-steel street barricade is now being manufactured by Utility Service Co., Inc., 1640 Thirteenth St., Racine, Wis. Trade-named "Bear-I-Cade," the new product claims many advantages over conventional wooden barricades. Besides being lighter in weight, it is easier to store, transport and set up. Eight-foot sections may be joined together to form solid barricades of unlimited length when conditions demand.

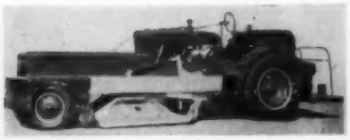
Finish is long lasting Rust-Oleum in a choice of standard construction colors. Convenient lantern hooks are provided on both ends of each 8-ft. unit. Entire unit made of heavy-weight steel tubing, precision welded at all joints.

"Bear-I-Cade" Barricade

For more information circle 158 on Service Coupon Page 16 and mail now.

Asphalt Pavement Heater-Planer

A new, improved model of the Monatco asphalt heater-planer, made under recently awarded U. S. Patent No. 2,705,906, announced by Monatco Manufacturing Corporation, 1401 Woodland, Kansas City, Mo., is claimed to greatly simplify the maintenance of asphalt streets, highways and airport runways. The machine is stated to thoroughly heat the asphalt, from top to bottom, soften it, and plane off all irregularities — in one operation. Ruts are filled and cracks sealed with pre-heated material. The new level surface can be opened to traffic, or can be re-surfaced if desired. Temperature under the heating hood is held uniform and constant, regardless of how fast the ma-



Monatco Asphalt Heater-Planer

chine may be moving, by a separate motor that operates the blower and fuel pump. Strict control over the air supply eliminates any possibility that the asphalt might be incinerated or damaged by the heat — and allows the temperature to be held several hundred degrees higher than was hitherto possible. Monatco's extra heat is stated to allow more thorough softening and conditioning of the asphalt before the planing blade reaches it. There is no smoke.

The planing blade, arranged in two sections to windrow in the middle, cuts up to 1 in. deep and 78 in. wide. The burner takes standard No. 2 fuel oil. Only one operator is required. Both operations, heating and planing, are performed in one pass.

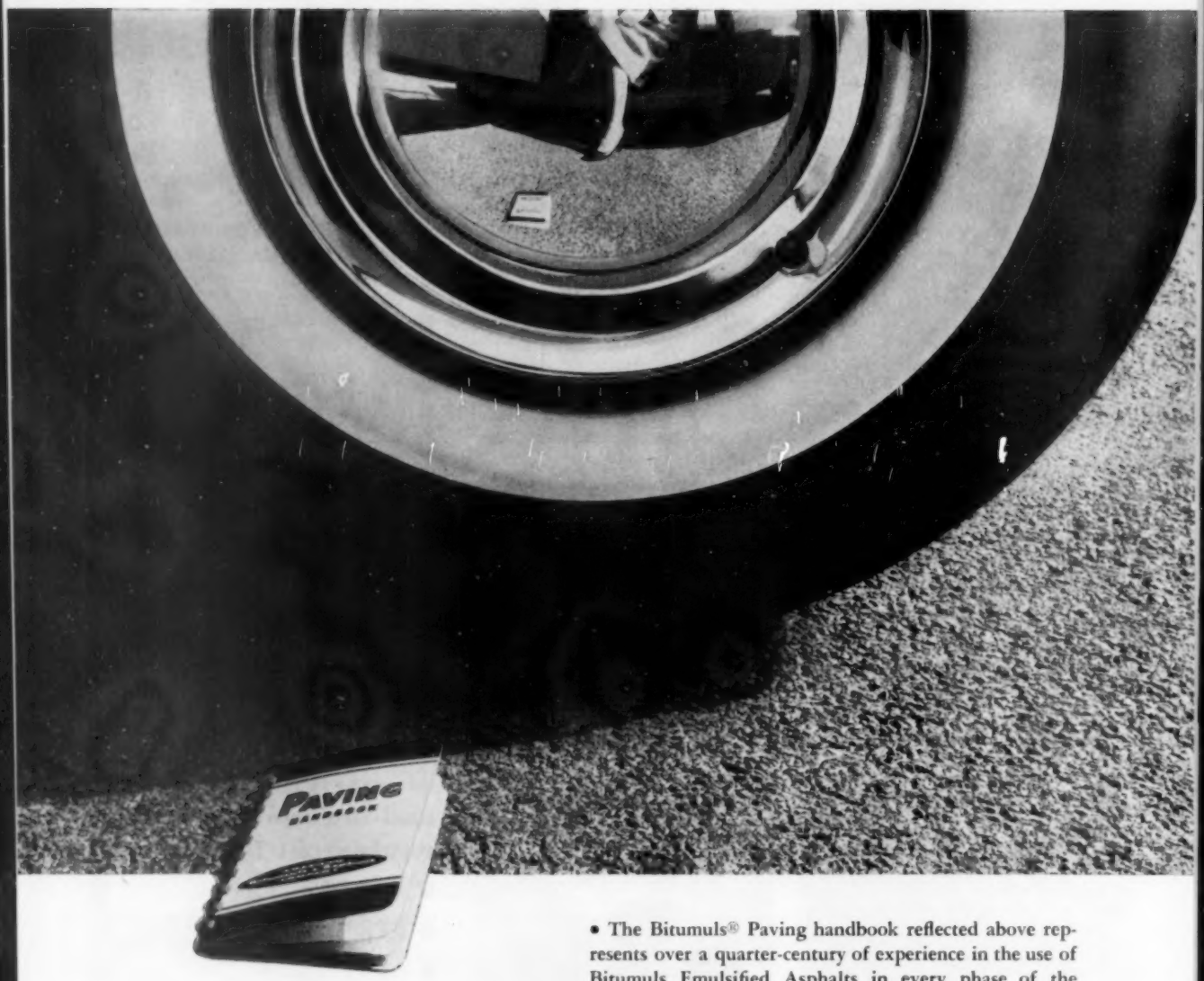
For more information circle 159 on Service Coupon Page 16 and mail now.

New Pedestrian Signal

A new pedestrian signal, announced by Eagle Signal Corporation, Moline, Ill., is engineered five ways to make it easier to see and easier to read. First the height of the letters has been increased to 3 in. Next, the lenses have been designed in distinctive colors and thus "cannot be confused with neon advertising signs." The "wait" or "don't walk" lenses are furnished in red or Portland orange. "Walk" lenses are furnished in green or lunar blue. Also, the sharp, square shape of the lens distinguishes the pedestrian signal from traffic lights, store signs and other lighting. And a new specially shaped prismatic reflector (see illustration for shape) is "designed for complete corner-to-corner lumination." The new pedestrian signal is illuminated by a standard traffic signal lamp without need for transformers.

Pedestrian Signal

For more information circle 160 on Service Coupon Page 16 and mail now.



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. . . for more details circle 253, page 16

FOR SALE

2—TOWERMOBILES, Complete—Mobile truck mount-hoisting tower with 1 cu. yd. hoisting bucket, 1½ cu. yd. tower hopper, 6x6 tower platform attachment, and 45 ft. tower. Completely portable for highway travel. Price F.O.B Seattle or Spokane $3,950.00

1—MODEL B SCOOPMOBILE 3/4 cu. yd. dual drive wheels, 8:25x20 — 9:00x16 steer, 12 ft. tower. Enclosed cab, lights completely overhauled. Price F.O.B. Seattle $1,395.00

1—AUSTIN WESTERN SWEEPER—with leaf broom spray system, lights, extra rear and gutter broom, 3 speeds forward, 1 reverse, Good condition. Price F.O.B. Seattle $1,595.00

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Phone Mutual 3388

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LOCATED IN MICHIGAN

NORTHWEST 25, Crane & Dragline, 35 Foot Boom, International Diesel Power $8,500
NORTHWEST 25, Crane & Dragline, 35 Foot Boom, Buda Gas Power $8,000
LORAIN TL 20, Backhoe, Powered by Waukeshaw Gas Engine $6,500
2-CATERPILLAR D8 Tractors Good Condition, Your Choice Each $3,500
HYSTER D8N Towing Winch Complete $1,250

LOCATED IN OHIO

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SULLIVAN 365 Cubic Foot Compressor Powered by Caterpillar D13,000 ..... $3,000
BUCKEYE 32 Wheel Type Ditcher $1,000
OWENS 2½ Yard Clamshell Bucket $1,500
BLAW KNOX 1½ Yard Clamshell Bucket $1,000
LORAIN 41 Backhoe Attachment $1,750
HENDRIX 3 Yard Dragline Bucket $ 375
CATERPILLAR D8 Push Blocks Each $ 75
LORAIN 40 Foot Boom Model 80-82 $ 500
2-ATHEY Bottom Dump 18 Yard Crawler Wagons Good Tracks Each $1,350

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GENERAL CONTRACTOR
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FOR SALE

6000, 9:00x20 Army combat tires and tubes, $20.00 each; 100, 11:00x 18 tires, tubes and 12 hole Budd wheels with 6 hole adaptors, $25.00 each; #1 Permatex, $1.25 per gallon; all size winches; used generator set, 4 cylinder gas engine, D.C. 28, 9V, 2 wire, 3000 rpm. Portable Waukesha, model D-APU, type C-13A, price, $150.00.

RECONDITIONED

6x6 G.M.C. trucks	$1,500.00
6x6 Dodge, 1½ ton trucks, winch	695.00
6x6 Dodge, 1½ ton trucks, without winch	595.00
6x6 Reo, 7½ ton trucks	2,500.00
6x6 Biederman, 7½ ton trucks	2,500.00
4x4 Chev. cargo with body & winch	750.00
4x4 Chev. Bomb carriers, AS 18	350.00
4x4 Chev. Bomb carriers, reconditioned	450.00
4x4 Chev. tractors	550.00
4x4 Dodge weapon carriers, ¾ ton	545.00
4x4 Autocar 5 ton trucks	1,000.00
4x4 Federal, 5 ton trucks	1,001.00
4x2 Chev. & Ford 1½ ton Cab & Chassis	300.00
4x2 Chev. & Ford 1½ ton Cab & chassis, AS 18	150.00
2000 gallon trailer	650.00
4000 gallon tank trailer	1,200.00
30 foot trailer	1,000.00
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28 foot trailer, tandem, van	1,500.00
C-2 Wrecker on Biederman	4,000.00
Athey wagons w/8, 9:00x20 combat tires.	395.00

We can furnish parts for any of the above trucks 1030 targs, 17x40, $50.00 each; 17x20, $26.00 each; extra heavy, like new with grommets and rope. Radiator hose in 3 foot lengths, size 1¼, 1¾, 1½, 2" $1.00 for 3 feet; size 2½ in 11" lengths, 25 cents each in lots of 40; used gun slings in lots of 5, 50 cents each; new C.H. Fink snow plow, V and straight blade, model 3598P, serial #92-9KE; large and small fork lifts.

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8 Euclid Tractors and Wagons
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6 Graders
4 TD-24 Dozers
6 D 7 and 08 Dozers
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Parts for all army Dodges.

Large Selection 9:00 x 16 tires.

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36" Kue Ken Gyracone — 10B & 13B Telsmith — 36" & 20" Sup. McCully — 7½K, 8K, 9K Gates A-C — 3042, 3648, 4042, 4248, 4880, 8466 Jaws — 2416, 3018, 4022, 2454 rolls — 8½'x22', Marcy #86, 5x10, 5x14, 6x12, 10x4 rod & ball mills — Smidth 16B tube mills — 15 & 22 ton Euclids — 42T & 25T blast hole drills & 50 ton ore cars — 85 ton trolley locomotives — Lima 1201 — N.W. 6, 80D, 95 — 7W, 9W, 200W Monighan — Manitowoc 3500 & 4500 — Page 618 & 620 — P&H 1600 — Marion 111 — B. E. 120B, 54B, 175B, 51B — 820 Lorain — P&H 1055 — 7x110, 10x120 kilns.

Crushing plants — rod, ball & hammer mills — gyratories — 2', 3', 4' Symons — roll & jaw crushers — screw, rake & bowl classifiers — compressors — converters — conveyors — drills — dump cars — motors — feeders — generators — hoists — kilns & dryers — pumps — locomotives — shovels & draglines — screens — transformers.

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5 cu. yd. Sauerman Power Dragline Scraper complete with hoisting engines, head posts, propelled car, etc. Good operating condition. Location in New Jersey.

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48B Bucyrus Erie Shovel 2 cy Diesel
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Backhoe Attachment for Keystone Model 18A with or without buckets. Also spare parts for above machine and Backhoe Attachment.

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2—Austin-Western patrol sweepers — each $2,500

1—½ yd. shovel attachment for Unit model 614 with 5th clutch, new, never been used $1,800

1—Besser concrete mixer, capacity 27 cu. ft., driven by 440 volts, 20 H.P. electric motor only used 1½ years $1,500

1—Construction broom for Ford tractor, used only once, good as new .....$ 498

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1—1947 ½ yd. Lorain dragline, 45' boom, ⅝ yd. drag bucket, ⅝ yd. clam bucket, gasoline engine $5,000

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All Wheel Drive
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These Trucks are in "Like New" condition with open or closed cabs. Ideal for Dump, Mixer or Crane Mounts or any on/or off road work.

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Caterpillar DW 15 tractor, S/N 45C-497, with No. 15 scraper. Save $2625 on this almost new machine. F.O.B. Detroit. $23,265

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Caterpillar DW20 tractor with 20S dozer and 27 cable control. Machine has cab, heater, lights and rear ballast box with ballast. In A-1 condition. F.O.B. Detroit.....$16,500

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L.P. or Cat. 80 Scoop

1—LS or Cat. 70 Scoop

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6,500 lineal feet Blaw Knox or Heltzel 10"x10" road forms.
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4,000 lineal feet 12", 14", 15" or 16" airport forms.
1—Barber Greene 879A asphalt finisher.
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Two Manitowoc 2000-Bs long booms — wide long Cats. Cat. diesels — erection cranes DL&CS.
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Bucyrus Erie 38-Bs. clam-drag-shovel and backhoes Wide long Cats. Cat. diesels.

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2—2 yd. Clamshell Buckets.
2—Austin Westerns, combination shovels and cranes. Rebuilt and working every day.
30—20 Ton Truck Cranes.

We carry the largest spare parts stock for Model 104 Northwests in the country.

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1—20 ton Industrial Locomotive Crane. Location Minnesota.

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1—TD24 International with dozer and PCU.
2—TD24 Internationals with PCU and pusher plates.
1—D8 Cat. and Scraper with bulldozer. Manganese tracks. Machine rebuilt in 1955.
1—D8 with Cat. 80 Scraper, new in 1954.
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1—Cat. D7 with dozer and PCU, new in 1953. Located Minnesota.
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2—Galions, model 118 Motor Patrol, new in 1953. The above machines are located in Minnesota.
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8—30 ton Macks, end dump. Model F-C-S-W. Seral No's. 1244-47-52-53-55-56-59-60. With approximately 50 tons of spare parts. Location Minnesota.
38—Euclid, Macks and Darts, all end dumps. From 12 ton to 34 ton, late model Trucks. All above Trucks are painted, cleaned, overhauled and ready to go into operation.
6—59TD, 22 tonners. Serial No's. 14913-15723-24-25-27-28.
10—No. 8 TD, 22 tonners. Serial No's 6581-82-84-89-72-96-97-90. Have N-H-R-S Cummins engines and heated boxes.
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1—Model W26 with dump body.
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8—LF 195 International tandem Tractors, 450 engines, large Henderson dollies.
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2036 Universal Jaw Crusher.
25 by 40 Roller Bearing Jaw Crusher.
Cedarapids Pitmaster Portable Crushing Plant, new in 1954.
The above equipment is located in our Wisconsin, Michigan, Indiana, Minnesota and Illinois Plants.

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1—27T Bucyrus Erie Blast Hole Drill complete with tools.
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2—Core Drills complete with tools. All above Drills are located in Minnesota.

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1—Auto Car with single axle Gram trailer.
1—New 50 ton Low Boy Trailer, legal width.
1—TD14 with 2 yd. Drott Loader, new cond.
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Model 105

With bulldozer attachment and dual rear tires. Excellent condition. $3,000.

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2	FD 15 ton Euclids	ea.	$ 6,000
6	59TD 22 ton Euclids	ea.	27,000
1	20TD 22 ton Euclid		12,000
3	20TD 22 ton Euclids	ea.	10,000
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8	8TD 22 ton Euclids	ea.	11,000
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MISCELLANEOUS

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The newest idea in 4 wheel drive tractors, dozers, loaders. The machine that gives you all the speed and manageability of a wheel tractor, and the power and traction of a crawler. 4 wheel drive at a cost you can afford.

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Diesel or gas, planetary steering (no steering wheel), Pivots in a 60" radius. 17:00 x 20 tires. Drawbar HP, 50 - Drawbar lbs. pull, 6000 in 2nd. Don't try any machine in the D-4 or HD-5 class till you see this. Available with any attachment.

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LORAIN SHOVEL FRONT

1 yard capacity, new, complete with dipper bucket and boom, will deliver.

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All late 1953 equipment and in excellent condition. Used on one job only.

Will sell all 4 pieces of equipment in a group for a substantial reduction.

CONDELL EQUIPMENT CO., INC.

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Phone: SOuth Amboy 1-2900

FOR SALE

1—LeTourneau FP Scraper, 90 per cent new. Six practically new tires. A-1 condition.

Call, Wire or Write to

B & H ROLLER COMPANY

ALBANY, GEORGIA — HEM. 2-0541

FOR SALE

Caterpillar D7, 3T with 7S hydraulic dozer with back rippers. Caterpillars D6, 8U with 25 control unit and 6S dozer. Both very good condition.

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FOR SALE

Immediate Delivery—Excellent Condition

OUTSTANDING VALUES IN USED ASPHALT PAVING EQUIPMENT

All Late Models

1—Barber Greene 848 asphalt plant, complete & in excellent condition ready to go. Priced right.

1—H & B asphalt plant, complete with 4,000 lb. pugmill & good shape thruout.

2—Barber Greene 879A asphalt finishers.

1—Galion 8-12 ton tandem roller.

1—Galion 5-8 ton tandem roller.

2—Galion 10 ton 3 wheel rollers.

2—Three axle tandem rollers.

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Dealer in Used Contractors Equipment

Office 36456 Nite 5668

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LAND CLEARING TOOLS

THE CROSSVILLE CLEARING BLADE

PATENT NO. 2,650,628

The most outstanding land clearing equipment on the market today. The Crossville Clearing Blade will clear from two to three times more land than any other clearing tool on the market. Will clear from 5 to 8 acres per day. Cuts off trees from one to three inches under ground, leaving no stump. Land ready for immediate use. Less disturbance of top soil. Cuts off trees up to 5 and 6 feet in diameter. Will also uproot trees same as dozer blade if necessary. Operating in 22 states. Have been used for clearing problems for levees, pipe lines, right-of-ways, reservoirs, lakes, strip mines, cultivation, pastures and many other operations. Tests prove that it costs much less to clear with this clearing Blade than with any other clearing method. These are made to mount on any kind and size of Crawler Tractor.

THE CROSSVILLE RAKE

The Crossville Rake has proved to be another very outstanding land clearing tool. This Rake is designed to pile large quantities of trees, brush, and surface roots into compact piles without gathering up a lot of soil with these. These soil free piles can be easily burned. It was originally made to pile trees, brush, stumps, and surface roots after the Crossville Clearing Blade had been used, but it has proved very satisfactory for many other operations.

Each tooth is a solid piece of 2½" steel. The Rake is a solid unit with these solid teeth an integral part. It will withstand rugged operations. It will "TAKE IT." The teeth are set so that they can be easily run at the desired level without "digging in." It is a strong, sturdy Rake that surpasses any on the market for piling brush, trees, stumps, and surface roots. This Rake was designed to meet the requirements of land clearing operations.

MANUFACTURED AND DISTRIBUTED BY

CROSSVILLE TOOL COMPANY

P. O. Box 13 — Phone 151 — Crossville, Illinois

FOR SALE

SHOVEL ATTACHMENT—for 603 Koehring, complete $2,250

SHOVEL ATTACHMENT—for Lorain 40, complete $1,250

LIGHT PLANT — Caterpillar 880 — 50 KW, like new $2,950

LOADER ATTACHMENT — Hough, for TD14 International, complete $1,750

Ernie Rieke Equipment Co.

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NORTHWEST "25"

¾ yd. Dragline, 40′ boom, Caterpillar Diesel Power. A bargain @ $8500.

INSLEY "L"

¾ yd. Trench Hoe or Dragline, 3 years old. Priced right @ $8500.

UNIT "514"

½ yd. Trench Hoe, Chrysler gas power. Reconditioned and Guaranteed @ $6000.

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New 75-Ton Aggregate Bin w/aggregate Batcher, Scales, Cement Batcher w/Scales, Collecting Hopper. Immediate delivery.

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Model 6 Northwest CRANE AND SHOVEL

Serial 13097. Fairleads and high gantry. D 13000 engine. Used mostly as concrete crane. Unusually fine condition. $32,000.

D. R. AGNEW Ronceverte, W. Va.

Capital to invest. Young contractor will invest up to $100,000 cash, and equipment valued at $150,000. Equipment consists mostly of late D4 and D7 Caterpillar tractors and trucks, etc. Contractor's previous experience is land clearing and road building for public utilities, but will consider investment or merger with any individual or company on equitable basis doing any type of contracting work anywhere.

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DRAGLINE, 3 yd. P&H Model 955 L.C. New in 1948. Buda diesel engine, 80′ boom with bucket. Owner spent over $20,000.00 rebuilding 14 months ago and $7,000.00 in last 60 days. Will take $20,000.00 loaded on trailer.

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60 Ton Fontaine Low Bed

BRAND NEW!!
FINEST MADE

(16) - 900x15 - 12 Ply Tires
Westinghouse Air Brakes
2 Speed Landing Gear
18′ Loading Platform
10′8″ Overall Width

$5900.00

F.O.B. Birmingham, Alabama
Plus 8% Federal Excise Tax
YOU CAN'T BEAT THIS!

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Rental Purchase

CRANES — DRAGLINES — SHOVELS
Model 802 Lima Crane-Dragline.
Model 603 Lima Crane-Dragline.
Model 650 Bay City Crane-Dragline.
Lorain 50-K, Crane, Dragline shovel.

EUCLIDS — Bargains
24—13-yd. Bottom Dumps, Cummins, GM and Buda Engines.

DUMPTORS
2—Model 60-W Koehring Dumpsters.

BUCKETS
¾ to 4 yd. dragline buckets.
¾ to 1½ yd. clamshell buckets.
½ to 2 yd. concrete buckets.

STEAM GENERATOR
Littleford Model 3500.

FINISHING MACHINES — Asphalt
Barber-Greene S/H 879-4-72.

PUMPS
1½″ to 6″ centrifugal.
4″ jet Gorman-Rupp.
6″ jet Peerless 3-stage.
3″ to 4″ Diaphragm.

HOISTS
Clyde & American, 1, 2 & 3 drum.

SAWS
20″ band, Skil, radial, DeWalt, table, Skil—hand, C-P (air), chain.
Wright (air) chain.

MISCELLANEOUS
Jeep Ditcher.
Williams Auger, 20 ft. truck mounted.
Sullivan Shalesaw.
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MODEL CR TOURNAPULL

With Model TS Scraper
Serial No. GM9T3632
Only 1300 Hours
A-1 Condition

If It Was Worth $28,000 New,
This Is A Steal!

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1951 White WC2264 Tandem Tractor.
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KRANE KARS

$2750.00 Each

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Reconditioned - pneu. and solids - 2,000 - 6,000 lbs. $795.00 & up

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(1) CAT. D13000, Serial No. 2U2610, Tractor mounting, Flywheel to radiator, A-1 condition	3500.00
(1) Waukesha 6WAL, Serial No. 665043, radiator, clutch housing, controls, starter and generator. Rebuilt . .	1800.00
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Continuous-mix pugmill, with or without drive. Aggregate bins and cement bins with feeders.

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Full diesel, 135′ boom, 5 cy. bucket, new 1948, excellent cond. Approximately $5,000.00 parts, 1 extra bucket. Price $100,000 FOB cars Coalgate, Oklahoma — Contact:

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DEPENDABLE USED MACHINES
Unit 1020A Diesel dragline
Bay City ⅝ yd. dragline
Universal 880 Diesel gravel plant
Jeep trencher
Dart 10 ton rock truck
45 ton port. steel bin

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FOR SALE

EQUIPMENT

Northwest 95 Dragline
54 B Shovel — Dragline Comb.
Manitowoc Model 4500 Shovel Dragline Comb.
Lima Paymaster Shovel Drag Comb.
3—Oliver H. G. 68 Wide Track Tractors
2—Northwest 25 Crane Dragline Comb.
T-9 Tractor
Byron Jackson Vertical Deep Well Pump 600 G.P.M.
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ATTACHMENTS

Shovel Front for Lima 802
Crane Boom For Lima 802
Lorain Crane Boom Fits 82 Or 820
Cat D 4600 Engine
2—D8 Dozer Blades
¾ Yd. Erie Clam Shell Bucket Never Used
2 New ¾ Yd Shovel Buckets
15000 Ft. 1½" Wire Rope on Spools New
6000 Ft. 1 3/16" Gal. 6 x 19 Hemp Center Wire Rope

Cable Suitable for Construction Equipment
All Unused on Original Reels.

SAVE UP TO 50 PER CENT ALL TXX ITEMS

Subject to Prior Sale. Call or Write

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Tel. Bedford 2-5151

FOR SALE

1—Jaeger 2 bag concrete mixer, Size 11½S, Continental motor. Purchased new in 1949 and used only 6 months. All pneumatic tires. Priced very reasonable.

1—CMC 21-ton, 2 compartment Bin Batcher, gate, supporting legs, 20' trolley tracks, 2 beam scales of roller bearing carriers and 26 cubic foot weight hopper. Purchased new in 1949 and used only 6 months. Priced very reasonable.

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City of Kenosha, Wisconsin is accepting applications for Engineers — both permanent and temporary. Salary range from $4200 to $6600 depending on experience.

Social Security, State retirement plan, Blue Cross, Blue Shield, 40-hour week.

Opportunity for diversified experience in street paving, storm sewers, sanitary sewers, water supply.

Apply City Manager
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34-E-GG-Rebuilt 1954 — Located 50 miles from Sioux City, Iowa

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Sioux Falls, So. Dak.

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Immediate Delivery—Excellent Condition

OUTSTANDING VALUES IN USED
CONCRETE PAVING EQUIPMENT

1—C.S. Johnson concrete plant w/135 yd. aggregate bin and 750 bbl. silo, elevator, complete.

1—Blaw Knox 600-650 bbl. cement silo.

1—Smith 2 yd. Model 56S tilting mixer.

1—C.S. Johnson concrete plant w/300 bbl. overhead silo w/dual batchers. 400 bbl. ground storage elevator and undertrack screw, complete.

2—Koehring 34E dual drum pavers-nearly new.

2—Jaeger and Blaw Knox 20'-25' concrete finishers and spreaders.

1—Buckeye R.B. Finegrader for 20'25'.

2—Blaw Knox 10'-15' spreaders and finishers.

1—Buckeye R.B. 10'-15' finegrader.

1—P & H Single Pass Stabilizer.

5,000 ft. Heltzel 10"x8" road forms.

5,500 ft. Blaw Knox 9"x9" road forms.

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4,400 ft. Heltzel 12"x16" reversible forms.

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FOUR Universal 2036 Primary CRUSHING PLANTS

Mounted on steel wheels, 24"x31' under crusher conveyors — all with MM gas engines. All new — unused surplus — Just received. Ready for shipment.

Subject to prior sale.

Price $12,500 each f.o.b. cars or truck, San Francisco.

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1¼ Yd. Bay City CRANE and SHOVEL

Cummins diesel, wide tracks. Good machine in the best condition. $18,000.

D. R. AGNEW Ronceverte, W. Va.

CEDAR RAPIDS SUPER ROCK-IT #22 portable. Single unit. 22"x25" RB Jaw, 30"x33" RB Hammermill. 30"x8' Apron Feeder. 42"x10' 2-deck horiz. screen. GMC Diesel 6-110. Mounted pneumatic tired tandem trailer. Cap. 75 to 100 TPH. Used little. Top condition. Priced at 40% of new price, or $22,500.00. Consider tonnage basis apply purchase price. Yard.

UNIVERSAL 10"x36" RB Jaw Crusher. Al. $3250. Yard.

PITTMAN HYDRO-CRANE, HEAVY DUTY Model 80. Serial #116 mounted on 1953 Ford F-8 Cab over chassis. Thornton tandem drive with two speed axles, air brakes. 10.00x20 tires. Less than 8400 actual miles. Good as new. Half price $8500.00. Rent with purchase option. Yard.

OSGOOD #200 Backhoe serial #5757. ½ cu. yd. Excellent. Also shovel attachment, dragline, boom, fairlead. $4000.00 complete. Rent $400/mo. apply purchase price. Yard.

LINK-BELT LS52 Dragline, ¾ cu. yd. Cat. Diesel. Independent boom hoist. New 1952. Used little. 50' boom. $7750.00. Rental purchase $750/mo. Yard.

P. & H. #655-B. Erection Crane. Serial #15257. Cat. D-13000. New 1953. Long crawlers, wide tracks. Cat. walk. 70' boom with 25' jib. Boom stop. Hi-gantry. Fairleads and tagline. Extra counterweight. Like new. $25,000.00. Rental purchase $1500/mo. S.E. Missouri.

KOEHRING #401 Dragline. Buda diesel engine put in lately. With 45' boom and 1¼ yd. dragline bucket. Good condition. $3500.00. $300/mo. Yard.

BACKHOE ATTACHMENTS FOR: —
Lima #304. ¾ yd. Like new. $1750.00.
Lima #604. 1½ cu. yd. de. $7500.00.
Lima #1201. 2½ cu. yd. $4500.00.
Link-Belt LS-85 ¾ cu. yd. $1500.00.
UNIT 10-20. ¾ cu. yd. $1750.00.

SHOVEL ATTACHMENTS. Send us your inquiries.

HENDRIX Dragline bucket. ½ cu. yd. Used one week. $300.00. Dallas, Texas.

KIESLER ½ cu. yd. Clamshell bucket. Medium Teeth. Counterweight. Excellent. $550.00. Yard.

BADGER 303-3 Trencher, Crawler mounted. Digs 16" wide, 11' deep. Used one season. Good. $2500.00. Rental purchase. Yard.

GRACE 4-wheel Sweeper with steel brush. New fibre brush. Good. $350.00 Dallas, Texas.

BUCKEYE 10' Spreader Nox Serial 10 S218. 4 tires. Good. $350.00. Dallas, Texas. Also 11'.

CONCRETE BLOCK PLANT. Ford, with mixer, conveyor, pallets, block machine, drying racks. Cap. 800 units day. Excellent. $650.00. Yard.

AUSTIN-WESTERN #40 Streetsweeper. Rebuilt. $1950.00. Rental purchase. Yard.

JAEGER 210' Portable Compressor. Rubber tired trailer. Cat. Diesel. Excellent. $2500.00. Rental $150/mo. apply purchase price. Others. Yard.

LITTLEFORD 2 - ton Sidewalk Roller. Rebuilt. $750.00. Yard.

WATSON STILLMAN 100-ton Hydr. Jacks. Independent pump and jack. 12" raise, 6" dia. ram. New in crates. 60% off new price. $200.00. Yard.

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3500 Manitowac Dragline, 85' Boom, 2½ yd. Bucket, D-17000 Cat. Engine. New 1949.

Price $23,500

1007 Osgood Dragline, 85' Boom, 2½ yd. Bucket, Buda Diesel Engine. New 1952

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GOOD USED EQUIPMENT

D-8 Caterpillar tractors
HD-20 Allis Chalmers tractors
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LaPlant-Choate scrapers, Model C-314
LS-85 Link-Belt Speeder shovel or dragline or backhoe
HC-90 Link-Belt Speeder crane
80-D Northwest shovels and draglines
1201 Lima draglines
855 P&H shovel-dragline combination

Other equipment for contractors. All in good condition.
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Foundation Investigations — Laboratory analyses and Evaluation of Construction Materials — Soil Mechanics, Concrete and Asphalt Technology. Field Inspection and Consultation. Special Investigations for Dams, Turnpikes and Airports.

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CATERPILLAR 12 Motor Grader 7T Series with Cab and Scarifyer New Tires $4,000
CATERPILLAR D8 Tractor with Cat. 25 PCU. and 8S Dozer 2U7100 Series $9,500
CATERPILLAR D4 Tractor with Caterpillar HT4 Hydraulic Hilift, 1600 Hours 7U19300 Series, Excellent Condition $6,750
LORAIN TL20 Moto Crane, Tandem Carrier 35 Foot Boom, Dual Controls, Boom Lowering Device, Factory Built $10,500
BUFFALO-SPRINGFIELD 8-10 Ton Tandem Roller, KT18, Hydraulic Steering $3,750
BUFFALO-SPRINGFIELD 5-8 Ton Tandem Roller, KT16, Hydraulic Steering $3,250
HUBER 8 Ton 3 Wheel Roller, Scarifyer, Caterpillar Diesel Powered, Hydraulic Steering, Only Used 277 Hours $3,250
GALION 8-12 Ton Tandem Roller Int. Diesel Powered, Hydraulic Powered $2,850
LAPLANTE CHOATE C314 Scraper 21.00x 24 Tires, 14 to 17½ Yards $5,500
LAPLANTE CHOATE C114 Scraper 18.00x 24 Tires, 13½ to 16½ Yards $4,250
BUCYRUS ERIE B170 Scraper 21.00x25 Tires, 15 to 19 Yards $5,500
LETOURNEAU L.S. Scraper 16.00x20 Tires, 8 to 11 Yards $3,350
LETOURNEAU F.P. Scraper 18.00x24 Tires, 14 to 18 Yards $3,500
LETOURNEAU M. Scraper 6-8 Yards $1,975
BUCYRUS ERIE S67 Scraper 6-8 Yd. $1,875
CATERPILLAR D13000 Power Unit, Complete with Closed Clutch, Radiator, Fuel Tank, Skid Mounted, and Hood $2,250
HYSTER D8 Worm Drive Winch $1,500
HYSTER D7N Towing Winch Complete $1,150
TRANSPORT 25 Ton Lowboy, Tandem, Air Brakes, Road Ready $2,000
15 NEW 18.00x24 Tires 20 Ply Factory Firsts, Standard Brands, Traction and Earth Mover Treads Each $425
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Vulcan and McKiernan-Terry
Steam Pile Hammers and Extractors
Drop Hammers — Driving Caps
Steel Leads — Pile Driver Hose
Hoists and Boilers

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100—Pcs. M-116 in 60 ft.—New, Chicago
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100—Pcs. M-116 in 60 ft.—New, Kansas City
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Available for Prompt Shipment
Other Lots at Various Locations

CONTRACTORS MACHINERY CO.
Phone VAlentine 4740 — 7637 SOUTHWEST BLVD. KANSAS CITY 8, MO.

USED ASPHALT PLANTS FOR SALE

Cedarapids Model F Mixing Unit — Hot elevator — elec. motor — hydraulic controls, complete w/running gear. Capacity — 50 tons per hour.

Ormander Asphalt Plant — Twin Driers, 36″x28′ and 30″x24′; — continuous 8′x12″ mixer — two elevators — Belt conveyor — 65-ton bin. Capacity — 30 tons per hour.

Both plants in good running condition

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We do a Nation-Wide business in

STEEL SHEET PILING

Available Immediate Shipment

780 pcs. MP-101—72 to 38 ft. West Coast
490 pcs. MP-116 & MP-115—60 & 50 ft. Illinois
375 pcs. DP-2 & AP-3—40 to 30 ft. New York
562 pcs. MP112 & MP116—40 to 30 ft. Kansas City
74 pcs. MP-112—50 & 40 ft. North Dakota
46 pcs. Inland I-22—50 ft. Missouri
85 pcs. MP-116—30 ft. St. Louis
140 pcs. Beth. DP-2—30 to 25 ft. Mississippi

Other lengths and sections new and used at other locations in the United States

McKiernan-Terry and Vulcan Pile Hammers and Extractors
Boilers, Hoists, Derricks, Cranes, Compressors, Railroad Equipment, Etc.

Regardless of location of job, write, wire or phone

MISSISSIPPI VALLEY EQUIPMENT CO.
509 Locust St., Chestnut 1-4474 St. Louis, Mo.

FOR SALE

1—T-D6 International Bucyrus-Erie Tractor and Dozer. Condition Good. $2,500
1—Caterpillar D4 and Dozer. Excellent Condition. 900 Actual Hours $6,250
1—D2 Caterpillar with Front End Loader. Starting motor and Diesel completely overhauled. Condition Good $3,000

Cooke Sales & Service Co.
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ENGINEERS — FOREMEN — OFFICE MEN

Learn latest methods to organize and run work. Prepare for the top jobs. Send post card for details.

GEO. E. DEATHERAGE & SON
CONSTRUCTION CONSULTANTS
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FOR SALE

1005 KOEHRING DRAGLINE Serial No. C-7644 Power-Cat. Engine, D364. Long Wide Cats 3½ cu. yd. Hendrix Heavy Duty Dragline Bucket, 100 ft. Boom, Type E Counterweights. 2000 Watt Kohler Light Plant. Used very little. Loc. at Elyria, Ohio.

Nick Cenci & Sons, Inc.
844 N. Cassady Avenue — Columbus, Ohio

WANTED TO TRADE

3½ yd. Shovel for 1½ yd. Shovel

FOR SALE

Euclid Rear and Bottom Dump Trucks
80D Northwest Shovel 2½ yd.
54B Bucyrus Erie Shovel 2½ yd.
1½ yd. Shovel and Dragline
S-152 Bucyrus Erie Scraper 18 to 20 yd.
4 yd. to 8½ yd. Electric Shovels
2 yd. to 7 yd. Draglines
35 Ton Rogers Lowbed Trailer

WILLIAM LUBRECHT, III
Construction Equipment
311 W. Diamond Ave. Hazelton, Penna
Phone Gladstone 5-4041

. . . for more details circle 181, page 16

With the Manufacturers and Distributors

WESTINGHOUSE ENTERS TORQUE CONVERTER FIELD. The Schneider Manufacturing Corporation, Muncie, Ind., a wholly-owned subsidiary of the Westinghouse Electric Corporation, has been dissolved to form the hydraulic drives department of the Westinghouse gearing division. The Schneider Manufacturing Co. was purchased by Westinghouse in October, 1934. The hydraulic drives department will sell, engineer, and manufacture hydraulic torque converters and associated brakes and transmissions. Headquarters of the department will remain at Muncie, Ind. S. M. Johns is sales manager.

WORTHINGTON PROMOTES GILROY. L. V. Gilroy, heretofore district representative at the Washington district office, has been appointed distributor supervisor of Worthington Corporation's Concrete Machinery & Contractors' Pump Division, Plainfield, N.J.

SAUERMAN BROS. MOVES. Sauerman Bros., Inc., have moved their general offices to 620 S. 28th Ave., Bellwood, Ill. This new office building is adjacent to their Bellwood plant and provides facilities for all departments.

HILL RESIGNS FROM GAR WOOD. E. R. Leeder, executive vice-president of Gar Wood Industries, Inc., Wayne, Mich., has announced with regret the resignation of E. B. Hill, director of sales and advertising. Hill, in his long tenure with Gar Wood, filled a number of responsible positions, culminating in the post he held at the time of his resignation. His resignation was motivated by personal reasons to follow his own business interests.

BORG-WARNER ACQUIRES BROOKS CO. Ingersoll Kalamazoo (Mich.) Division of Borg-Warner Corp. has acquired Brooks Equipment and Manufacturing Co., Knoxville, Tenn. It will be operated as a subsidiary of Borg-Warner.

HUBER-WARCO NAMES 6 NEW DISTRIBUTORS. Huber-Warco Co., Marion, O., has appointed the following distributors for its complete line of tandem rollers, three-wheel rollers and graders: Elphinstone, Inc., 6212 Belair Road, Baltimore, Md.; Long-Talbott Equipment Co., 820 Blossom St., Columbia, S. C.; Boehek Engineering Co., Inc., 5806 Long Drive, Houston, Tex.; Wilhelm-Davies Co., Inc., North Colony Road, Route 5, Wallingford, Conn.; Kessler-Simon Machinery Co., 1545 Exchange Ave., Oklahoma City, Okla.; R. B. Wing & Son Corp., 384 Broadway, Albany, N. Y.; Dempster Bros., Inc., Knoxville, Tenn.

PLEHN REJOINS B-E SALES STAFF. John H. Plehn has rejoined Bucyrus-Erie Co., as a sales representative for general purpose excavators and drills. He has been assigned to the Seattle office under the supervision of R. P. Brooks, Northwestern sales manager.

CUMMINS ADVANCES FOUR. E. O. Tull is now executive vice-president of Cummins Engine Co., Inc., Columbus, Ind. R. B. Stoner is the newly elected vice-president—personnel; C. R. Boll, vice-president—sales, and P. J. Emery, general sales manager. These advancements were made following the annual meeting of Cummins shareholders on April 5.

MORGAN NEW SPECIAL REPRESENTATIVE FOR HARNISCHFEGER. Harnischfeger Corporation, Milwaukee, Wis., has appointed Ray Morgan as special representative for its Power Crane and Shovel Division. He will promote and coordinate all sales activities for P&H single base soil stabilizer and P&H Sierra elevating loader.

UNION METAL NAMES DISTRICT REPRESENTATIVES. A. W. Crary and G. C. Buchanan have been appointed district representatives for The Union Metal Manufacturing Co., Canton, O. Crary, for the past 31 years a street lighting specialist with the General Electric Co., will represent Union Metal Co. in Kansas; also in parts of Oklahoma, Arkansas and Missouri. Buchanan, likewise, was a General Electric lighting specialist for 25 years in the states of Texas and Oklahoma where he will continue to operate in his new capacity.

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ESCO APPOINTS KANSAS CITY REPRESENTATIVE. Roy Weeks has been appointed district representative for the Kansas City territory for the Electric Steel Foundry Co., Danville, Ill. His address will be 5219 Juniper Drive, Mission, Kan. Prior to this appointment he was a sales engineer for Esco in the Portland and Western Oregon areas.

RUBIN APPOINTED SALES ENGINEER. Foundation Equipment Corporation, Long Island City, N.Y., and Chicago, Ill., who manufacture and rent wellpoint pumping equipment, has appointed A. S. Rubin as sales engineer to serve contractors in the south. His headquarters will be in Fort Pierce, Fla.

NEW HENSLEY DISTRIBUTOR. Karremi Tractor & Equipment Co., Cheyenne, and Casper, Wyoming, has been appointed exclusive dealer by Hensley Equipment Co., San Leandro, Calif. for the state of Wyoming and western Nebraska.

DETROIT DIESEL ADDS TO FIELD ORGANIZATION. Due to an expanded and more complex diesel engine market and new models added to its line of industrial and marine diesels, the Detroit Diesel Engine Division of General Motors, Detroit, Mich., has added five more sales and service representatives to its administrative field organization. The new representatives, advanced from home office sales and service departments in Detroit, will help man new sales and service zones created by a rearrangement of previously existing territories.

The men appointed and their territories as announced by E. F. Bentley, Detroit Diesel's general sales manager are: G. R. Holly, sales representative, covering Arizona, New Mexico and Utah; Stanley Partel, sales representative, covering the Dakotas, Minnesota and Eastern Iowa; K. L. Post, service representative in Colorado, Montana, Nebraska and Wyoming; Vance Shields, service representative in Northern Illinois, Michigan and Wisconsin, and R. A. Stephens, service representative, covering Western New York, Ohio, Western Pennsylvania and West Virginia.

NEW MANITOWOC DISTRIBUTORS. Manitowoc Engineering Corp., Manitowoc, Wis., has announced the following new distributors for its line of power cranes and shovels: Dalton-Cooper, Inc., 200 W. 54th St., New York, N.Y.; in various parts of Europe and the Orient; Compressed Air Equipment, Ltd., 328 Du-Pont St., Toronto, Ont., for Ontario; Automotive Products Co., Ltd., 3282 Wellington St., Montreal, Que., for Quebec; Union Hispano Americana, S.A., Ezequel Montes 102, Mexico 4, D.F., for republic of Mexico.

NEW LETOURNEAU-WESTINGHOUSE DISTRIBUTOR. Reddco Equipment Co., Bedford, O., has been named LeTourneau distributor for northern portion of Ohio. Reddco is currently operating from an office at 550 Krich Road, Bedford. A new building is now under construction at Northfield, O.

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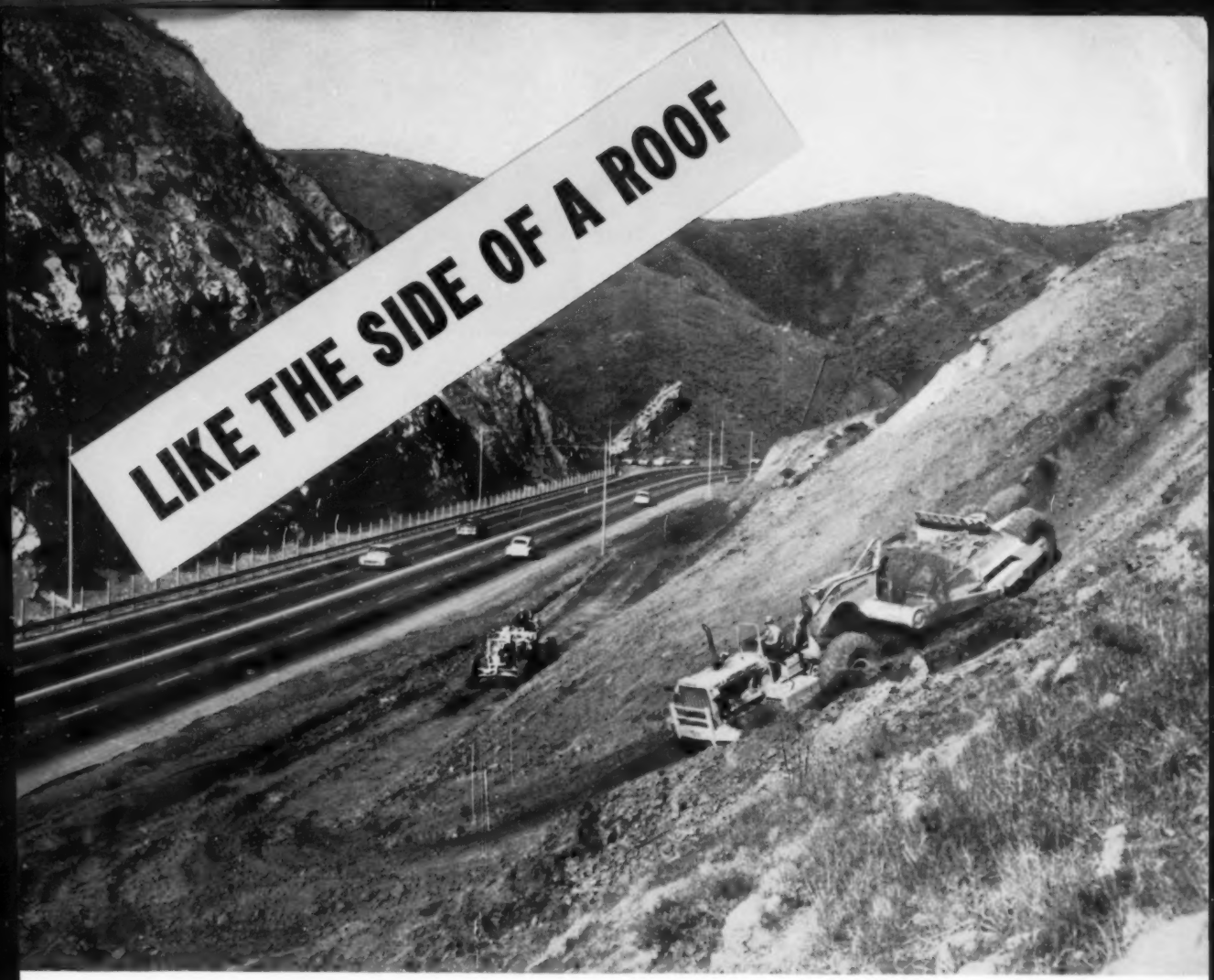
Advertisers with * are represented in the 1955 edition of Gillette's Heavy Construction Prefiled Catalog. Please refer to it for additional information on any of their products.



On the Waldo Grade project, at the northern end of San Francisco's Golden Gate Bridge, Guy F. Atkinson Company contracted to move 1,500,000 cu. yd. of earth on some really tough grades.

To widen Rt. 101 to a six-lane highway a rocky hillside had to be cut away and the heavy material hauled half a mile down to the fill, in a deep ravine.

Those 20 per cent grades were like the side of a roof. But Atkinson's fleet of CAT* DW20 Tractors and No. 20 Scrapers got the job done. They hauled big loads down the steep slopes and switchbacks, then made their way to the top again after dumping. There have been few more convincing tests of the DW20's stamina and lugging power.

Eleven of the big wheel rigs were used on this $4,000,000 contract. Other Caterpillar equipment included D8 Tractors for push-loading and bulldozing, No. 12 Motor Graders to work on the haul roads and Caterpillar Diesel Engines powering compressors. Many successful contractors believe in standardizing on the big yellow machines — service and maintenance are simplified, parts are often interchangeable, and operators are familiar with the equipment. Caterpillar dependability, freedom from down time and long work life are clinching arguments for standardization.

Your Caterpillar Dealer will demonstrate the big production and low operating cost of the DW20 Tractors, and he'll back every machine he sells with on-the-job service and genuine Cat parts.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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*Both Cat and Caterpillar are registered trademarks — ®

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YOUR DEALER
WILL DEMONSTRATE**

. . . for more details circle 171, page 16

Galion Allsteel Model 19TTE Excavator trailer dump with 45 ton Model 88381 Duo-scopic Hoist.

1,920 cubic yards a day on a 15 mile haul

Galion Allsteel Model 19TTE Excavator trailer dumps are outstanding performers in the excavating equipment fleet of Greco Contractors, Chicago, Illinois.

Greco operates 8 of these units on the Congress Street Expressway job in Chicago. Loaded by shovel or dragline, each of these trailer dumps handles up to 30 cubic yards of material and makes 7 to 8 fifteen mile round trips to the dump each shift, through heavy traffic.

Built to haul large quantities of excavated material over the highway to distant disposal points, Excavator trailers are engineered to provide even weight distribution on trailer and tractor axles. And, they are constructed to withstand the damaging effects of shovel loading.

An order for 3 additional Model 19TTE's has just been placed by Greco Contractors. Describing the Congress Street job, Mr. P. J. Greco says: "We are hauling a mixture of rock, broken concrete and a very sticky mud. The combination of 6-inch radius floor corners, tapered body, barn door type tailgate and good dump angle gets rid of the material with no difficulty. Stability in dump position is remarkable. We also like the way the load is distributed on the trailer and tractor axles."

Find out how Galion Excavator trailer dumps can meet your heavy material hauling requirements. Your nearby Galion Allsteel distributor will recommend the model exactly suited to your job. Call him today! AA-1233

THE DUO-SCOPIC GALION ALLSTEEL BODY COMPANY • GALION, OHIO

DIVISION OF CENTRAL OHIO STEEL PRODUCTS COMPANY

. . . for more details circle 187, page 16